"बिजनेस पोस्ट के अन्तर्गत डाक शुल्क के नगद भुगतान (बिना डाक टिकट) के प्रेषण हेतु अनुमत. क्रमांक जी. 2-22-छत्तीसगढ़ गजट/38 सि. से. भिलाई, दिनांक 30-5-2001."

पंजीयन क्रमांक "छत्तीसगढ़/दुर्ग/09/2010-2012."

छत्तीसगढ़ राजपत्र

(असाधारण)
प्राधिकार से प्रकाशित

क्रमांक 349] रायपुर, शनिवार, दिनांक 31 दिसम्बर 2011—पौष 10, शक 1933

Chhattisgarh State Electricity Regulatory Commission
Irrigation Colony, Shanti Nagar, Raipur (C.G.) - 492 011

Raipur, the 30th December 2011

No. 40/CSERC/2011.— In exercise of powers conferred under section 86(1) (h) read with Section 181(ZP) of the Electricity Act, 2003 (No. 36 of 2003), the Chhattisgarh State Electricity Regulatory Commission hereby makes the following Regulation to be known as **"Chhattisgarh State Electricity Grid Code 2011"**

CHAPTER - 1

INTRODUCTION & DEFINITIONS

1.1 Introduction

The Electricity Act, 2003 (Act here after) in Section 86 (1)(h) states that the State Commission should specify a State Grid Code which shall be consistent with the Indian Electricity Grid Code **(IEGC).** In compliance to above provision of the Act, Chhattisgarh State Electricity Regulatory Commission (CSERC) notified "Chhattisgarh state Electricity Grid Code-2007" in consistent with the "IEGC-2005". Now that the Central Electricity Regulatory Commission (CERC) has notified new "IEGC Regulations 2010", hence this Grid Code has been made which is consistent with the CERC (Indian Electricity Grid Code) Regulations, 2010. This Grid Code shall be a legally enforceable, interface document agreed upon and to be complied with by all entities connected to the state transmission system. The Grid Code has been designed to ensure an efficient and coordinated State transmission system and allow State transmission utility (STU) to comply with its obligations in relation to the intra state as well as interstate (wherever applicable) transmission of power.

1.2 Short title, extent and commencement

1. These Regulations shall be called "Chhattisgarh State Electricity Grid Code, 2011" or "State Grid Code-2011".
2. These Regulations shall extend to the whole of Chhattisgarh.
3. These Regulations shall come into force from the date of its publication in the Chhattisgarh Rajpatra.

1.3 Definitions

In these Regulations unless the context otherwise requires:

1. **"Act"** means the Electricity Act 2003 (36 of Act 2003), including amendments thereto;
2. **"Active Energy"** means the electrical energy produced, flowing or supplied by an electrical circuit during a time interval, and being the integral of the instantaneous power with respect to time, measured in units of watt hours or standard multiples thereof:

   1,000 Wh = 1 kWh = 1 Unit, 1,000 kWh = 1 MWh, 1,000 MWh = 1 GWh = 1 MU (Million Units)
3. **"Active Power"** means the product of voltage and the in-phase component of alternating current measured in units of watts and standard multiples thereof :

   1,000 W = 1 kW, 1,000 kW = 1 MW, 1,000 MW = 1 GW
4. **"Apparent Power"** means the product of voltage and current measured in units of volt amperes and standard multiples thereof, which is:

   1,000 VA = 1 kVA, 1,000 kVA = 1 MVA, 1,000 MVA = 1 GVA
5. **"Apparent Energy"** means the integral of the apparent power with respect to time. It is measured in Volt Ampere hour and standard multiple thereof, which is:

   1,000 VAh = 1 kVAh, 1,000 kVAh = 1 MVAh, 1,000 MVAh = 1 GVAh
6. **"Apparatus"** means the electrical apparatus and includes all machines, fittings, accessories and appliances in which conductors are used.
7. **"Authority"** means the Central Electricity Authority referred to in sub-section (1) of Section 70 of the Act.
8. **"Automatic Voltage Regulator** "(AVR) " means a continuously acting automatic excitation system to control the voltage of a generating unit as measured at the generator terminals;

9. **"Backing Down"** means the instructions of SLDC or WRLDC conveyed through SLDC, for reduction of generation of a generating unit under abnormal conditions such as high frequency, low system demand or network constraints;

10. **"Beneficiary"** means a person buying power from SGS,ISGS,InSGS using STU and/or CTU and/or transmission licensees network and who have Transmission Service Agreement with the STU /Transmission Licensee/CTU.

11. **"Black Start Procedure"** means the procedure necessary to recover the grid from a partial or total blackout;

12. **"Breakdown"** " means an occurrence relating to equipment of supply system which prevents its normal functioning;

13. **"Bulk consumer"** means a consumer who avails supply at voltage of 33 KV and above through open access;

14. **"Central Electricity Regulatory Commission" or "Central Commission"** means the Commission set up under Section 76 of the Act;

15. **"Central Transmission Utility" or "CTU"** means any Government company which the Central Government may notify as such under sub-section(1) of section 38;

16. **"Commission" or "CSERC"** " means the Chhattisgarh State Electricity Regulatory Commission;

17. **"Connection point"** means a point at which a user's and/or generating plants apparatus are connected to the intra-State transmission system;

18. **"Connection Agreement"** means an agreement between STU, intra-state transmission licensee other than STU (if any) and any person setting out terms related to a connection to and / or use of intra-state transmission system.

19. ***"Control Area Customers"*** (CAC) means "A generating station connected to ISTS or connected with ISTS and the State network (both)" and whose any of the activity of real time monitoring, scheduling, dispatch control, energy accounting etc are executed by SLDC as per the provisions of the IEGC.

20. **"CSPTCL"** means Chhattisgarh State Power Transmission Company Limited acting as State Transmission Utility (STU).

21. **"Demand"** means the demand of active power in MW, reactive power in MVAR and apparent power in MVA of electricity unless otherwise stated;

22. **"Data Acquisition System"** means a system provided to record the sequence of operation in time, of the relays/equipments as well as the measurement of pre selected parameters;

23. **"Df/dt Relay "** means a relay which operates when the rate of change of system frequency (over time) goes higher than a specified limit and initiates load shedding ;

24. **"Dispatch Instructions"** means an instruction by SLDC to SGS, InSGS to dispatch generation and to distribution licensee/bulk consumers/ to regulate drawal in accordance with the Scheduling & Dispatch procedure of Grid Code;

25. **"Distribution Company (Discom) or Distribution licensee "** means a company engaged primarily in the business of distribution and supply of electricity in its area of supply and licensed to do so under Section 12 of the Act;

26. **"Distribution System"** means the system of wires and associated facilities between the delivery points on the transmission lines or the generating station connection as the case may be and the point of connection to the installation of the consumers.

27. **"Despatch Schedule"** means a State Generating Station / InSGS scheduled to be exported to the grid from time to time.

28. **"Drawal Schedule"** means the submission of the station-wise ex-power plant drawal schedules from SGS / InSGS and drawal from state grid consequent to intra-State open access transaction.

29. **"Disturbance Recorder "** means a device provided to record the behavior of the pre-selected digital and analog values of the system parameters during an events;

30. **"Drawal"** means the electricity taken out from the intra state transmission system.

31. **"Event"** means a unscheduled or unplanned occurrence in the intra State Transmission system including faults, incidents and breakdowns;

32. **"Event logging facility"** means a device provided to record the chronological sequence of operations, of the relays and other equipments;

33. **"Extra High Tension (EHT)" or "Extra High Voltage (EHV)"** means voltage higher than 33kV;

34. **"Fault Locator"** means a device provided at the end of a transmission line to measure/indicate the distance at which a line fault may have occurred.

35. **"Flexible Alternating Current Transmission (FACT)"** means facilities that enable power flow of A.C lines to be regulated, to control loop flows, line loading etc.;

36. **"Generating Plant"** means a generating station which shall include a captive generating plant (CGP) connected to state grid and includes a generation plant /CGP coming under the control area of SLDC as per provision of IEGS;

37. **"Grid Code"** means "Chhattisgarh State Electricity Grid Code - 2011".

38. **"High Tension (HT)" or "High Voltage (HV)"** means voltage higher than 650V but which does not exceeds 33 kV under normal conditions.

39. **"Indian Electricity Grid Code" or "IEGC"** means the central grid code specified by the Central Commission in accordance with sub section 1(h) of Section 79 of the Act.

40. **"Inter-State Generation Station" or "ISGS"** means a Central generating station or other generation station in which two or more states have shares;

41. **"Intra State generating Station" or "InSGS"** means any generating station including Captive generating plant (CGP) which is only connected to State grid;

42. **"Intra State Transmission System" or "State Transmission System" or "InSTS" or "State grid"** means any system for conveyance of electricity by transmission lines within the area of the state and includes all transmission lines, sub-stations and associated equipment of transmission licensee of the state;

43. **"Intra-State user"** means a person such as a generating company including captive generating plant or transmission licensee (other than CTU and STU) or distribution licensee or bulk consumer including captive user whose electrical plant is connected to the State grid at voltage level of 33 KV and above.

44. **"Low Tension" or "Low Voltage"** means voltage 650 Volt and below.

45. **"Maximum Continuous Rating"** (MCR) means the normal rated full load MW output capacity of a generating unit, which can be sustained on a continuous basis at specified conditions;

46. **"Maximum demand"** means the 4 times maximum value of average KVA delivered to consumers at the point of supply during any consecutive period of 15 minutes during the month computed on either block interval or sliding window principle of measurement.

47. **"Operation"** means a schedule or plan action related to the operation of a system;

48. **"Open Access Regulation"** means the Chhattisgarh State Electricity Regulatory Commission (Connectivity and Intra State Open Access) Regulation, 2011.

49. **"Peak Period"** means the period in a day when demand for electricity is at its highest or as directed by the Commission.

50. **"Planned Outage"** in relation to all InSGS unit means outage of power generating units and in relation to transmission facility means outage of transmission lines and equipments, which have been planed and agreed with SLDC in advance, during a year;

51. **"Reactive Energy"** means the integral of the Reactive Power with respect to time. It is measured in volt amperes reactive hours and standard multiple thereof, that is:

1,000 VArh = 1 kVArh, 1,000 kVArh = 1 MVArh, 1,000 MVArh = 1 GVArh

52. **"Reactive Power"** means the product of voltage and current and the sine of the phase angle between them measured in units of volt amperes reactive and standard multiples thereof, that is:

1,000 VAr = 1 kVAr, 1,000 kVAr = 1 MVAr, 1,000 MVAr = 1 GVAr

53. **"Single Line Diagram"** means diagrams which are a schematic representation of the HV/EHV apparatus and the connections to all external circuits at a connection point incorporating its numbering nomenclature and labeling;

54. **"Site Common Drawing"** means drawings prepared for each connection point, which incorporates layout drawings, electrical layout drawings, common protection/control drawings and common service drawings;

55. **"Spinning Reserve"** means the reserve capacity of a generating station which is partially loaded, synchronized to the system and is ready to provide increased generation at short notice pursuant to dispatch instruction, or instantaneously in response to a frequency drop;

56. **"State Load Despatch Centre" or "SLDC"** means the centre established under sub-section (1) of section 39.

57. **"State Sub-Load Despatch Centre" or "SSLDC"** means the offices and associated facilities of the State Load Despatch centre set up at places other than the location of the SLDC for monitoring and control of the State grid;

58. **"State Generating Station" or "SGS"** means any the generating stations owned by the companies owned or controlled by the State Government;

59. **"State Transmission Utility" or "STU"** means the Government Company specified as such by State Government under sub-section (1) of Section 39 of the Act.

60. **"Static VAR Compensator"** means an electrical facility designed for the purpose of generating or absorbing Reactive Power;

61. **"Supervisory Control and Data Acquisition" or "SCADA"** means the combination of transducers, remote terminal unit communication links and data processing systems which provides information to the SLDC on the operational state of the State transmission system;

62. **"Synchronize"** means the condition where an incoming generating unit or system is connected to another system so that the voltage, frequencies and phase relationships of that generating unit or system, as the case may be, and the system to which it is connected are identical and the terms "synchronize" and "synchronization" shall be construed accordingly.

63. **"Time block"** block of 15.00 minutes during which energy meter records specified electrical parameters. For recording of MD in MW or MVA the measurement during the time block may be either on block interval or on sliding window principle.

64. **"Under Frequency Relay"** means a relay which operates when the system frequency falls below a specified limit and initiates load shedding

Words or expressions used herein and not defined shall have the meanings assigned to them under the Act and other Regulations issued by the Commission/Central Commission.

1.4 Application of other codes etc.

1. This code shall be read along with the, Chhattisgarh State Electricity Supply Code, Chhattisgarh State Electricity Regulatory Commission (Connectivity and Intra State Open Access) Regulation, 2011, other relevant provisions of the Act, and relevant Standards / following Regulations issued by Central Electricity Authority along with amendments thereon, rule and regulations made there under.
   - (i) Central Electricity Authority (Installation and Operation of Meters) Regulations, 2006
   - (ii) Central Electricity Authority (Installation and Operation of Meters) Amendment Regulations, 2010
   - (iii) Central Electricity Authority (Technical Standards for Connectivity to the Grid) Regulations, 2007
   - (iv) Central Electricity Authority (Safety Requirements for Construction, Operation and Maintenance of Electric Plants and Electric Lines), Regulation, 2008,

(v) Central Electricity Authority (Measures relating to Safety and Electric Supply), Regulation, 2010.

(vi) Central Electricity Authority (Grid Standards) Regulation, 2010

(vii) Central Electricity Authority (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations, 2010.

(viii) Central Electricity Authority (Safety Requirements for Construction, Operation and Maintenance of Electric Plants and Electric Lines), Regulation, 2011,

2. Where any of the provision of this Code is found to be inconsistent with those of the Act, rules or regulations made there under, not withstanding such inconsistency, the remaining provisions of this Code shall remain operative.

3. Where any dispute arises as to the application or interpretation of any provisions of this Code, it shall be referred to the Commission whose decision shall be final and binding on the parties concerned.

4. Wherever extracts of the Electricity Act, 2003, are reproduced, any changes /amendments to the original Act shall automatically be deemed to be effective under this Code also

5. All Users who are connected to and/ or use the InSTS, shall comply with the relevant regulations and Chhattisgarh State Electricity Regulatory Commission (Intra-State ABT, Unscheduled Interchange charges and related matters) Regulations, to be notified and amendments thereon.

1.5 Structure of Chhattisgarh State Electricity Grid Code, 2011.

This State Grid Code contains the following chapters, namely:

Chapter - 1 : Introduction - This Chapter contains introductory parts of the Grid code and definitions of related terminology used in the Code.

Chapter - 2 : General - This part largely deals with the scope and application of these regulations and with Grid review Committee;

Chapter - 3 : Planning Code - This Code specifies the principles, procedures and criteria that shall be used in planning and development of intra-State transmission system;

Chapter - 4 : Connectivity Conditions and criteria - Connection Conditions specify the minimum technical and design criteria that shall be complied with by a Transmission Licensee and User connected to or seeking connection to the intra-State transmission system;

Chapter – 5 : Operating Code - This Code describes the conditions under which the State Load Despatch Centre shall operate the intra-State transmission system and under which Intra-State Users shall operate their facilities, in so far as necessary to maintain the security and quality of supply and safe operation of the intra-State transmission system.

Chapter - 6 : Scheduling and Despatch Code - This Code deals with the provisions related to development of Scheduling and Despatch Code for the State of Chhattisgarh.

Chapter -7 : Protection Code - This chapter deals with standard protection practices to be adopted for transmission lines sub-stations connected to State Transmission System.

Chapter - 8 : Metering Code - This chapter covers the standard technical specifications of metering practices to be employed in Transmission system connected to State Grid.

Chapter - 9 : Contingency Planning - This chapter outlines the contingency plan to be adopted by the entities connected to State Grid in case of total or partial outage of Transmission system.

Chapter - 10 : Safety Standards - This chapter describes safety standards to be adopted in operation of State Grid.

Chapter - 11 : Operation Event and Incident Reporting - This chapter describes the manner of operation and incident reporting by the entities connected to State Grids.

Chapter - 12 : Data Registration - All the users of State Grid have been made responsible for proper data logging and data communication to STU. This chapter describes these issues.

Chapter - 13 : Miscellaneous - This part deals with a number of miscellaneous aspects including compliance with the State Grid Code, Power to amend, power to remove difficulties and dispute resolution etc.

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CHAPTER - 2

GENERAL

2.1 Scope of regulation and extent of application

2.1.1 These regulations shall be applicable to-

i. every Transmission Licensee in the State including State Transmission Utility (STU);

ii. the State Load Despatch Centre (SLDC);

iii. Every User who is connected to and/or uses the intra-State transmission system:

iv. All Users connected with and/or utilizing the Intra-State Transmission System (InSTS) are required to abide by the principles and procedures defined in this code/IEGC in so far as they apply to that User.

2.1.2 Transmission Licensee, forming part of the InSTS, and User, having connection(s) with the InSTS, should comply following requirements under these regulations.

i. Enter into a connection agreement in accordance with chapter - 4;

ii. Provide protection systems in accordance with Chapter - 7;

iii. Provide communication facilities and compliance of telemetry requirement in accordance with Chapter - 4;

iv. Provide for system recording instruments in accordance with Chapter - 12;

v. Develop Single Line Diagrams in accordance with clause 4.8.2 of Chapter - 4;

vi. Develop Site Common Drawings and site responsibility schedule in accordance with Clause 4.8.3 of Chapter -4 ;

vii. Installation and Operation of meters in accordance with Metering Code developed as per Chapter - 8.

2.2 Availability of Chhattishgarh State Electricitry Grid Code- 2011

The Commission, SLDC and STU shall display a copy of the State Grid Code - 2011on their website. Printed copy of the State Grid Code - 2011 shall be made available by State Transmission Utility to any person at a price not exceeding the reasonable cost of printing it.

2.3 Role of STU and SLDC

The STU shall be responsible for managing and implementing this Code. The STU and the SLDC shall discharge such functions and responsibility as entrusted to them under the provisions of the Act and any other regulations issued by the concerned authority in an independent and un biased manner.

In addition to above the SLDC shall also be responsible for "Operation of State UI pool Account, "State reactive energy Account" and "Congestion Charge Account" etc as may be provided in the relevant regulations. Provided that in event of a SLDC being operated by the STU, as per first provision of sub-section (2) of Section 31 of the Act, adequate autonomy shall be provided to the SLDC for it to be able to discharge its functions in the above mentioned manner.

2.4 State Grid Coordination Committee:

2.4.1 The State Grid Coordination Committee shall consist of the following members:

i. Managing Director of Chhattisgarh State Power Transmission Company Limited (CSPTCL) - Chairman

ii. Executive Director / Chief Engineer or In-charge of SLDC - Member Secretary

iii. Executive Director / Chief Engineer nominated by Chhattisgarh State Power Generating Company Limited (CSPGCL) - Member

iv. One representative nominated by SLDC- Member

v. One representative nominated by each of distribution licensees - Member

vi. One representative from each of Transmission licensees other than STU - Member

vii. One representative from generating plants other than the CSPGCL with installed capacity of 500 MW and above connected with state grid - Member

viii. One representative of the association, if any, of other generating plants other then at (vii) above - Member.

Note: Members mentioned at (vii) and (viii) above will have tenure of two years.

2.5 Functions of the committee.

2.5.1 The functions of the State Grid Coordination Committee shall be as follows: -

i. Facilitating the implementation of these regulations and the rules and procedures developed under the provision(s) of these regulations.

ii. assessing and recommending remedial measures for issues that might arise during the course of implementation of provisions of these Regulations and the rules and procedures developed under the provisions of these Regulations;

iii. review of the State Grid Code, in accordance with the provisions of the Act and these Regulations; and suggest to the Commission, the necessary amendments/changes required to be brought, in these regulations for smooth operation of the power sector and in the interest of overall compliance to the provisions of the Act

iv. to study such other matters as may be directed by the Commission from time to time.

2.5.2 The Committee will meet at least once in six months.

2.5.3 The Member Secretary shall present all proposals to the Committee for its consideration. The outcome of the meeting should be informed to Commission within 15 days.

2.5.4 The Committee may set up sub-committees for detailed study of related problems. The sub-committees may discuss with an Intra-state User its individual requirements and with groups of users to prepare proposals for the Grid Coordination Committee.

2.5.5 The recommendations of the Committee may be submitted to the Commission for consideration and approval. The Commission may amend the Grid Code on suo-motu or on the recommendations of the Committee as may be deemed fit. However, before any amendment is made in this code, comments on the proposed changes shall be obtained from the Intra-state users and the public.

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CHAPTER - 3
PLANNING CODE

3.1 Transmission system planning

3.1.1 In accordance with section 39 (2) (b) of the Act, the STU shall discharge all functions of planning and coordination relating to the state transmission system (STS) with CTU, State Govt., Generating Companies, Regional Power Committees, Central Electricity Authority, Licensee and any other person notified by State Government in this behalf which may utilize the state transmission system for evacuation or drawal of power from state transmission system.

3.1.2 The system planning specifies the technical and design criteria and procedure to be adopted by STU for the planning and development of the transmission system. The users of the transmission system shall take such system planning into account for planning and development of their own system. The STU in consultation with the Intra-State users shall evolve an efficient, secured and economical intra-state transmission system in order to satisfy the requirements of demand and generation.

i. The STU shall upload on its Internet website the approved transmission system plan for the InSTS (intra-State Transmission System).

ii. The transmission system plan shall cover a plan period of ten (10) years commencing from control period of five years. Business plan be got approved for five years of control period. Subsequent five year plan will be tentative and will be subjected to approval of the Commission. Approved business plan be reviewed every year and proposal for change, modification, addition or alteration in business plan be submitted by 30th September of every year for examination and approval. STU may also carryout change, modification in their tentative plan based on changed needs and may upload it in its website.

iii. The transmission system plan shall include the proposed intra-State transmission schemes for system strengthening for the benefit of Intra-state Users, as per business plane approved by the Commission. The transmission system plan may include information related not only to intra- State transmission lines but also additional equipment including transformers, capacitors, reactors, Static VAR Compensators and Flexible Alternating Current Transmission Systems: Provided further that the transmission system plan shall also include information on progress achieved on the identified intra-State transmission schemes and system strengthening schemes.

3.1.3 The formats of the transmission system plans shall be provided to distribution / transmission licensee by the State transmission utility and the same shall be available in the website of STU.

3.1.4 The need for reinforcement and extension of the system arises due to many reasons of which a few are mentioned below:-

i. The development on a user's system already connected to the state transmission system.

ii. Introduction of a new connection point between Intra-state user's system and the transmission system.

iii. The need to increase system capacity, removal of operational constraints, maintenance of security standards and meeting general increase in demand.

iv. Steady state and transient stability considerations.

v. Cumulative effect of any combination of the above four.

3.1.5 The development of the transmission system must be planned in advance duly allowing sufficient lead time, considering the following:

i. The time required for detailed engineering, design and construction work to be carried out. The system planning therefore enforces the time scales for exchange of information between the STU and the user(s). All the concerned parties, wherever appropriate, shall have due regard to the confidentiality of such information;

ii. The time required for obtaining the necessary statutory approvals such as notification in government gazette Power and Telecommunication Co-ordination Committee (PTCC) clearance, Forest clearance, Railway clearance, clearance from civil aviation authorities, National highways, State highways etc., and the right of way permissions wherever required, shall also be taken into account.

3.2 Perspective Plan:

3.2.1 Load forecasting shall be the primary responsibility of distribution licensees within their area of supply. The distribution licensees shall determine the base load, peak load and energy forecast of their areas for ten years starting from commencement of five year control period for which business plan will get approved by STU from the Commission subsequently annual change in the data if any be submitted to STU every year. These shall include the details of demand forecasts, data methodology and assumptions on which the forecasts are based. The peak load and energy forecast shall be made for the overall area of supply. The STU shall also review the methodology and assumptions used by the distribution licensees in making the

load forecast, in consultation with them. The resulting overall forecast will form the basis of planning for expansion of transmission system, which will be carried out by the STU.

3.2.2 The STU shall forecast annual peak load for each connection point / interface point with the transmission system by considering the developing load of distribution licensee and long term open access requisitions by different generating stations. The peak load requirement at each connection point / interface point will be ensured by the STU. It may determine the corrective measures to be taken to maintain the capacity adequacy in the transmission system up to the connection point / interface point. This will facilitate the transmission licensee to develop a compatible transmission system. However, if the distribution licensee receives power at a number of connection points/interface points in a compact area, which are interconnected in a ring then the load forecast should take care of that of transmission system the maximum load at any point of time is to be taken. These forecasts shall be updated annually and also whenever major changes are made in the existing system.

3.2.3 The STU shall be responsible to prepare a long-term (10 years) plan for the compatible expansion of the intra-state transmission system to meet the future demands.
Such planning shall be in conformity with followings:

i. Perspective plan formulated by CEA.
ii. Electric Power Survey of India published by the CEA.
iii. Transmission Planning Criteria and guidelines issued by the CEA.
iv. Operational Feedback from RPC, RLDC and SLDC.
v. Chhattisgarh State Electricity Regulatory Commission (Connectivity and Intra-State open access) Regulation, 2011 as amended from time to time.
vi. Any capacity addition in State.

This compatible intra-state transmission plan shall also include provision for reactive compensation needed for the transmission system.

3.3 Planning Standards and Procedures:

The State Transmission System shall be planned in accordance with the "Transmission Planning criteria" issued by CEA. The Transmission System Planning and Security Standard are the guidelines for planning and expansion of Transmission System in the State. The long term perspective planning involves an integrated approach for evacuating power from different generating stations under long term open access irrespective of their ownership, and delivering it to the beneficiaries over an optimally designed transmission system with reliability, security and economy. The power system in the State grid has to be planned in

such a manner, that the power received from all generating plants, share of power from Western grid and central sector generating stations, can be transmitted without constraints to different beneficiaries, as per their allocated shares, maintaining a reasonably good voltage profile, stability conditions and redundancy criteria.

The transmission planning should be developed to achieve a strong coordinated power system for the State, Western region and ultimately a national grid, where substantial inter-regional transfers can be achieved with optimized utilization of available generation. The transmission planning shall also provide a high standard of supply to beneficiaries with acceptable degree of reliability and at reasonable cost. The criterion should be that even under the conditions of the specified outages considered in the security standards, the power flow should not be affected. The transmission lines and sub-stations shall be so planned that the same can be upgraded when necessary in future, with minimum interruptions and modifications.

For the purpose of reducing inventory, procurement time and installation time, the transmission licensee shall adopt standardized designs as far as possible for transmission line towers, structures for sub-stations, sub-station lighting, control room lighting and ventilation, sub-station earthing, standardized specification for line materials, transformers, substation equipment, cables, bus bar accessories, insulators, hardwares, lightening arrestors etc.

The possibility of providing adequate connections within the State grid with inter state grid has to be considered wherever economically feasible considering all economic energy / capacity interchanges. The modern Flexible AC transmission system (FACTS) based on thyristor based controls, HVDC, fast controllable phase shifters etc., have also to be considered wherever economically feasible and / or constraints of corridor for construction of new transmission lines.

The scope of planning standard should cover:

i. system studies;
ii. assessment of the system data;
iii. assessment of generation availability;
iv. planning criteria;
v. security conditions required for maintaining specified degree of reliability;
vi. criteria for sub-station planning; and
vii. estimation of reactive power compensation required.

3.3.1 **System studies:**

i. The loads to be supplied from various sub-stations at steady state condition within the limits of declared voltage and acceptable frequency of 50 Hz and the future load development has to be assessed after making a detailed study of the present conditions and a load survey. A reasonable estimation of transmission losses shall also be included for arriving at peak availability, The system is to be further evolved based on the following power system studies:

(a) Load flow

(b) Optimal power flow for various conditions

(c) Short circuit

(d) System stability – steady state

(e) System stability – transient

(f) Studies to determine switching / temporary over voltages

(g) Other studies as required.

ii. These studies require suitable computer programs. The models incorporating generation, transmission and load shall be prepared separately for each year of a plan period assessing probable year of commissioning of particular lines, substations, additional transformers in existing sub-stations etc., based on the system network for the year in question with all the generation and load buses properly located. Inter connections with the neighboring states at 400kV and 220kV levels shall also have to be incorporated. Appropriate equivalent circuit models shall be used to take into account the fault level at the connection points / interface points. The interconnection buses shall be modeled by representing significant and necessary portions of the neighboring networks to represent realistically the MW and MVA imports/exports. Studies shall be carried out both for peak load and zero load conditions.

3.3.2 **Assessment of System data**

To arrive at a reasonably accurate load forecast and for conducting studies, compilation and updating of system data is absolutely necessary. The planning study should begin with the proper representation of the existing system to establish the base case and to validate the model. The results obtained from the existing system should be verified with the meter readings, logged data at the sub-stations and the State Load Despatch Centre to closely match the same. The system parameters have to be updated incorporating the correct data whenever addition or modifications have been carried out on the system either by the survey of the correct line lengths and conductor configurations or preferably by direct measurement of the line impedance values whenever and wherever possible. All the system

data shall be the same for both the planning standards and operation standards. The loads shall be modeled at 220KV and 132KV buses. The annual minimum load shall be taken as a percentage of annual peak demand as prevailing in the base year.

3.3.3 **Assessment of Generation availability:**

For peak load conditions, different generation mixes of various generating stations, resulting in an optimal average cost shall be determined by conducting the required number of load flow studies, or using well developed computer software packages to determine the same. For the minimum load conditions, the generator which "must run", shall be used in conjunction with the most economical generation. The generation dispatch for the purpose of sensitivity analysis corresponding to a complete shutdown of a major generating station shall be worked out by increasing the generation at other stations to the extent possible keeping in view the maximum likely availability at those stations, cost of power, etc. transmission constraints will have to be addressed properly. The transmission system being planned shall consider the adequacy of the network required to transmit power even under various outage conditions specified in the security standards. Studies shall be repeated for normal and contingency conditions as required in the security standards.

3.3.4 **Planning criteria:**

The Central Electricity Authority (CEA's) "Manual on Transmission Planning Criteria" shall be adopted with modification particularly with reference to steady state voltage limits and security standards in such a way so as to maintain steady state voltage within limits as per clause 5.2.17 of this code.

(a) **Line loading limits:**

The permissible line loading limits shall conform to CEA's "Manual on Transmission Planning Criteria". The over loading and under loading of lines shall be decided accordingly. Maximum line loading capacity as considered in the CERC (Rates and Charges and Terms and Conditions for use of intervening Transmission Facilities) Regulations, 2010 is as under:

Sr. No.	Voltage	Line loading capacity Considered (MW)
1.	400	450
2.	220	250
3.	132	90
4.	66	27

However, in view of CEA's "Manual on Transmission Planning Criteria" and looking to thermal limit and conductor size used, voltage wise maximum quantum of power permissible for injection into state grid is shown as in clause 4.2.1 of this code.

(b) Options for strengthening of transmission network:

i. Addition of new transmission lines to avoid over loading of existing system (wherever three or more circuits of the same voltage class are envisaged between two sub-stations, the next higher transmission voltage may be considered).

ii. Up-gradation of the existing transmission lines such as raising height of conductor supports and / or switch over to insulated cross-arms to facilitate change over to higher voltage, if the tower design so permits.

iii. Replacement of conductor of the existing transmission line with higher size of conductors or with AAAC (All Aluminium Alloy Conductor).

iv. The choice shall be based on cost, reliability, right of way requirements, energy losses, down time, etc.

v. All single circuit lines shall be planned generally with double circuit towers, wherever technically feasible, to enable future expansion without right of way problems. Construction of multi circuit tower can also be planed to resolve right of way problem.

3.3.5 **Security standards:**

(a) Steady State Stability:

Security is the ability of the electric system to withstand sudden disturbance such as electric short circuit or unanticipated loss of system element, detailed in Clause 6 of "Manual on Transmission Planning Criteria" issued by CEA. The State Transmission System shall be designed for a security level of "n-1" i.e. to withstand a single contingency with little negative effect. This means the most severe fault or tripping of a critical generator, transformer or line should not result in instability of the system, overloading of lines and/or transformers for more than 15 minutes, voltage drop of more than 10% when the system import is increased by 20%. State Transmission Utility /Transmission Licensee shall maintain the system security level of "n-1" (single contingency) plus spinning reserve margin for Steady State Operation.

220 kV	40 kA for 1 sec
400kV	40 kA or 50 kA for 1 sec
765 kV	40 kA or 50 kA for 1 sec

* 1 or 3 sec. Duration may be decided as per fault level.

(e) While sub-station planning, Insulation level of transformers and reactor windings and bushing should be taken as per following table as specified in CEA (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulation, 2010.

Rated Voltage	Windings			Bushings		
	Rated power frequency withstand voltage (kVrms)	Rated switching impulse withstand voltage (kV peak)	Rated lightning impulse withstand voltage (kVpeak)	Rated power frequency withstand voltage (kVrms)	Rated switching impulse withstand voltage (kV peak)	Rated lightning impulse withstand voltage (kVpeak)
800kV	-	1550	1950	880	1550	2100
420kV	-	1050	1300	630	1050	1425
245kV	395	-	950	460	-	1050
145kV	275	-	650	275	-	650
72.5kV	140	-	325	140	-	325
52kV	95	-	250	95	-	250
36kV	70	-	170	70	-	170
24kV	50	-	125	50	-	125
17.5kV	38	-	95	38	-	95
12kV	28	-	75	28	-	75

3.3.7 **Transmission line planning criteria:-**

(a) Transmission System:-

(1) The transmission System shall be planned in an integrated manner and optimized considering the total network under Central Transmission Utility (CTU) and State Transmission Utility (STU), and any other transmission licensee in area.

(2) The adequacy of the transmission system shall be tested for one or more load generation scenarios comprising of peak and off peak conditions in summer, winter and monsoon seasons.

3.3.6 Substation planning criteria:

For meeting a particular quantum of load, the number of required Sub-stations depends upon the choice of voltage levels, the MVA capacity and the number of feeders permissible etc. The number of EHT transformers, Interconnecting Transformers shall also be considered in planning to take care of contingencies of planned/forced outages. In all EHV sub-station (132 KV and above) should have at least Two transformers. The following criteria can be adopted:

(a) The capacity of any single substation at different voltage levels shall normally not exceed the following as per CEA (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations, 2010.

765 kV	4500 MVA
400kV	1500 MVA
220 kV	500 MVA
132 kV	150 MVA

(b) Size and number of Interconnecting Transformers (ICTs) shall be planned in such a way that outage of any single unit would not overload the remaining ICTs or the underlying system. Normally there should not be more than three power transformer / ICT in EHV sub-station.

(c) Size and number of Transformers in EHV sub-station shall be planned in such a manner that in the event of outage of any single unit, the remaining transformers may supply adequate load. This has to be achieved in such a manner that, with the connection of the adjacent Sub-stations, the load exceeding the capacity of the available transformers may be transferred on to neighboring sub-station.

(d) The rated rupturing capacity of the circuit breakers in any Sub-station shall not be less than 120% of the maximum fault levels at the sub-stations. (The 20% margin is intended to take care of increase in short circuit levels as the system grows). The minimum rated rupturing capacity and duration of switchgear at different voltage levels are as follows as per CEA (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations, 2010:

11 kV	16 kA for 1 sec in urban area. 12.5 kA for 1 sec in rural area
33 kV	25 kA for 1 sec.
132 kV	31.5 kA for 1 or 3 sec*

The system shall be planned to withstand satisfactorily without any load shedding or altering the generation at generating stations for at least, any one of the following outage conditions:

(a) Outage of any tower in a Double Circuit (D/C) transmission line.

(b) Two circuits of 132kV or 220kV lines.

(c) One circuit of 400KV line

(d) One interconnecting transformer

(e) One largest capacity generator

(f) One inter-connecting line with neighboring grid.

The above contingencies shall be considered assuming a pre-contingency system depletion (planned outage) of another 220kV double circuit line or 400kV single circuit line in another corridor and not emanating from the same sub-station. All the generating stations shall operate within the limits as per their reactive capability curves and the network voltage profile shall also be maintained within the specified voltage limits.

(b) Transient stability:

The system shall be designed to maintain synchronism and system integrity under the following disturbances:

(a) Outage of the largest size generator in the State grid or connection with neighboring grids.

(b) A single line to ground fault on a 400 kv line, single pole opening of the faulty phase (5 cycles) with unsuccessful reclosure (dead time 1 sec) followed by 3 pole opening (5 cycles) of the faulty line.

(c) 400 kV D/C line.

(i) When both the circuits are in operation, the system shall be capable of withstanding a permanent fault on one of the circuits followed by a three-pole opening (100-m.sec.) of the faulty circuit.

(ii) When one of the circuits is under maintenance / outage the system shall be capable of withstanding a transient fault on the circuit in service.

(d) A permanent 3-phase fault with duration of 8-cycles on 220 kV or 132kV line assuming three-pole opening.

(e) No stability studies for faults are required for radial lines.

(3) Right of way for transmission lines shall be optimized keeping in view the corridor requirement for the future by adopting suitable alternative of multi-circuit/or multi-voltage lines as found suitable.

(b) Routing of Transmission Line – The transmission line route shall be selected keeping in view the following:

(1) Routing of a transmission line through protected or reserved forest shall be avoided. In case it is not possible to completely avoid the forests or areas having large trees, keeping in view the overall economy, the route shall be aligned in such a way that cutting of trees is minimum. Routing of a transmission line through National Parks or Wild Life sanctuaries should also be avoided.

(2) Restricted areas such as civil and military airfields shall be avoided care shall also be taken to avoid aircraft landing approaches.

(3) The line routing should avoid large habitations, and densely populated areas.

(4) It shall be ensured that all statutory requirements stipulated under Forest Conservation Act, Wild Life Protection Act, Archeological Survey Act and other Acts/Rules/Laws, as may be applicable, are complied with.

(5) The Owner shall arrange all required consents and approvals including those from Power and Telecommunication Co-ordination Committee (PTCC), and for civil aviation, road, river, rail, canal or power line crossings, way leaves and environmental & forest clearances etc. from the concerned authorities/agencies.

(6) Right of way and way leave clearance shall be arranged by the Owner in accordance with the requirements of construction. Compensation for right of way & way leaves shall be given as per applicable law, rules & regulations, guidelines and directives of local administrative and revenue authorities.

(c) Salient technical particulars and requirement of transmission lines:- Electrical Design Parameters of transmission lines -

Parameter	132 kV AC	220 kV AC	400 kV AC	765 kV AC	500 kV DC
Nominal voltage (kV)	132	220	400	765	500
Highest system voltage (kV)	145	245	420	800	525
Full wave impulse withstand voltage (1.2/50 micro sec.) (kV peak)	650	1050	1550	2400	1800
Power frequency withstand voltage under dry condition (kV rms)	275	460	680	830	-
Switching surge withstand voltage under wet condition (kV rms)	-	-	1050	1550	1000

Minimum corona extinction voltage under dry condition (kV rms) phase to earth	-	156	320	510	550
Maximum radio interference voltage (micro volts) at 1 MHz for phase to earth voltage of ____ kV under dry condition	-	1000 at 156kV	1000 at 267kV	1000 at 510kV	1000 22 kV/cm con-ductor sur-face gra-dient

(d) Normal design span for various voltage level transmission lines shall generally be as shown below :

Voltage (kV)	Normal span (meters)
765	400, 450
400	400
220	335, 350, 375
132	315, 325, 335

3.3.8 **Reactive compensation:**

(a) **Shunt capacitors:** Shunt capacitor shall be installed at 33 kV and 11 kV system preferably at load centres. In case it is not possible at load centre, then reactive compensation shall be provided in 132 kV systems with a view to meet the reactive power requirement of load close to the load points. The capacitors shall be of automatic switched type for sub-station of 5 MVA and higher capacity. In case of sub station loaded with highly fluctuating loads like arc furnaces etc., flickers and voltage regulation problems shall be overcome by installation of static var compensators (SVCs)

(b) **Shunt reactors:** Switch-able shunt reactors shall be provided at 400 kV sub-stations for controlling voltages within the limits specified. The step changes shall not cause a voltage variation exceeding 5%. Suitable Line Reactors (Switch- able/Fixed) shall be provided to enable charging of 400kV lines without exceeding voltage limits specified.

The Standard sizes (MVAR) of reactors are -

(i) 400 kV (3-ph units) 50, 63 & 80 at 420 kV

(ii) 765 kV (1-ph units)50, 63 & 110 at 800 kV

The line reactors shall be installed for long line at high voltage level for curtailing switching over voltage and limiting the fault currents.

3.4 To enable the STU to discharge its responsibilities under the transmission license by conducting system studies and preparation of the perspective plans, all the Intra-state users shall furnish the necessary data to STU from time to time as given under Data Registration Chapter 12 and categorized as planning data (PD),. vide ***Annexure-A*** The data pertaining to InSGS running parallel with grid, shall be updated on any addition of generating unit / modification of the distribution / transmission system.

3.5 To enable the Intra-state users to co-ordinate planning, design and operation of their plants and systems with the transmission system they may seek certain salient data of the transmission system as applicable to them. STU/transmission licensee shall supply these data as per ***Annexure-B*** categorized as Detailed Transmission System Data.

3.6 In addition to the above provisions, the planning code of the Indian Electricity Grid Code (IEGC) which calls for data exchange shall also apply to the generating companies, transmission licensees, utilities and distribution licensees regarding generation / transmission of energy from inter-state transmission systems.

3.7 One time data as per Annexure "A" shall be submitted within 3 months from the date the Grid Code comes into effect, by all the concerned, to the STU. Also, all concerned have to intimate the changes, if any, in the data provided as one time data. In reporting of such data CSERC (Connectivity and Intra-State Open Access) Regulation, 2011 as amended from time to time should be followed.

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CHAPTER - 4

CONNECTIVITY CONDITIONS AND CRITERIA

4.1 Introduction & Objective

(i) Users connected to/ or seeking connections to intra-state transmissions system shall comply with CEA (Technical Standards for Connectivity of Grids) Regulations, 2007 and Chhattisgarh State Electricity Regulatory Commission (Connectivity and Intra State Open access) Regulations, 2011 wherever applicable.

(ii) Wherever the State grid is connected to the Inter-State transmission system, the provisions relating to connection conditions of IEGC will prevail.

(iii) The objective of connectivity condition specified in this chapter is as given below.

a. To ensure safe operation, integration and reliability of the state grid.

b. The basic rules for connectivity conditions are complied with, in order to treat all Intra-state users in a non-discriminatory manner.

c. Any new or modified connection when established should not impose unacceptable effect on the system and/or on Intra-state user of system.

d. Any person seeking connectivity to the grid is required to be aware of in advance, the procedure for connectivity to intra-state transmission system and also standard and condition, its system has to meet for being integrated with state grid

4.2 Connection points/interface points:

4.2.1 **Generating Stations**: The voltages at which a generating station may be connected with the grid of transmission or distribution licensee (as applicable) can be 400, 220, 132 or 33 KV. The connection point/interface point shall be the point at the sub-station of the licensee system where power is injected. The metering point shall be at the connection point / interface point.

Following are the prescribed quantum for injection of power to the state grid with reference to voltage of injection: -

Sl. No.	Voltage of injection	Maximum Quantum of power that can be injected into grid
1.	33 KV	Up to 15 MVA
2.	132 KV	Up to 75 MVA for single circuit and 150 MVA for double circuit
3.	220 KV	Up to 200 MVA for single circuit and 400 MVA for double circuit

Note: **1.** For arriving at the quantum of power to be injected in MVA, power factor as indicated in the nameplate or the design details of the generator will be taken into account.

2. Under special circumstances, any deviations from the above limits may be considered by the licensee subject to technical feasibility and specific approval by the Commission. Subject to fulfillment of minimum technical requirement of meter as specified at clause no. 8.6 of this code.

3. Provision for redundancy in dedicated transmission line shall be the responsibility of generator concerned.

4.2.2 All the generating stations including captive generating plants (CGP) having injection and / or drawal requirements of more than 15 MVA shall have connectivity with the grid under either of the following modes, at their own cost, subject to technical feasibility :-

1. At nearest EHV sub-station through dedicated EHV transmission line.
2. At pooled / switching / load catering / step up EHV sub-station with dedicated EHV transmission line.
3. No tap connectivity at EHV line shall be allowed.

4.2.3 All the generating plants including captive generating plants having injection and / or drawal requirements from the grid up to and including 15 MVA shall have connectivity with the grid under either of following modes, at their own cost, unless otherwise specified by the Commission subject to technical feasibility:-

1. At nearest EHV sub-station through dedicated 33 KV line.
2. At nearest 33/11 KV sub-station through dedicated 33 KV line.
3. At 33 KV switching or pooling sub-station through dedicated 33 KV line.
4. No tap connectivity on 33 kv line shall be allowed.

4.2.4 All the existing generators including CGPs connected with the grid under any modes other than prescribed at Clause 4.2.2 and 4.2.3 shall have to ensure connectivity with the grid as per prescribed options given in Clause 4.2.2 / 4.2.3 failing which their connectivity shall be liable for disconnection from the grid. However, Commission may allow such connection for certain period on request of the Intra-state user as a special case on compelling reasons.

Connectivity through pooling substation will be allowed only if found technically feasible. The cost of common infrastructure like, transmission line, switchgear / step up transformer or

any other equipment/infrastructure including the facility for real time data transfer/ communication etc. as the case may be, shall be borne by the constituent generators/CGP(s) in proportion to their respective power injection to the grid.

An existing generating plant, presently not covered under clause 4.2.2 and 4.2.3, shall be subject to load-shedding plan of CSPDCL as and when enforced, till their connectivity is as per clause 4.2.2 or 4.2.3 as the case may be.

4.2.5 **Distribution Licensee:** The connection point / interface point shall be the outgoing feeder gantry of transmission licensee's sub-station. The metering point can be at 33 or 11 kV side of EHV power transformer at transmission licensee's sub-station. In case of EHT consumer, the connection point /interface point shall be metering point on incoming feeder gantry of EHT consumer substation. The distribution licensees shall maintain the metering equipments at the connection point / interface point in case of EHT consumers. In case of multiple distribution licensees metering shall be at their respective interface point. All the terminal equipments for communication, protection and metering within the premises of the transmission licensee shall be owned and maintained by the transmission licensee.

4.2.6 **Connections with other transmission systems**: The connection, metering and protection scheme, metering point and the voltage of Transmission System of other state shall be in line with the agreement between the CTU and STU / transmission licensee. The connection with transmission systems of any other transmission licensee within the state shall be in accordance with the agreement between the concerned licensees.

4.3 Procedure for applications for connection to the transmission system:

Any generator/Captive Generating Plant/licensee/Open access customer seeking to establish new or modified arrangements for connection to and/or use of the transmission system shall submit an application along with prescribed fee as decided by CSERC as per procedure as defined in regulation 10 of Chhattisgarh State Electricity Regulatory Commission (Connectivity and Intra State Open-Access) Regulations, 2011 as modified from time to time.

4.4 General principles and conditions for grid connectivity: -

Grid connectivity shall be generally provided subject to the following conditions: -

1. All Intra-state users or prospective users are treated equitably.
2. A system of acceptable quality is ensured by specifying the required minimum standards for the design and operational criteria to assist the Intra-state users to comply with the license obligations.

3. The ownership and responsibility for all equipments is required to be clearly specified in the "site responsibility schedule" for every site where a connection is made.

4. Interconnection of a 132 KV to 400 KV AC sub-station (depending on the bus configuration) with the transmission and generator feeder / lines be terminated into bays containing one or more breakers.

5. The paralleling of generator / captive generator would be allowed only after ensuring proper protection schemes adopted by the generator/captive generator on inter-connecting feeders and proper operational measures (provision of sectionalizer, breaker etc. at generators end). The list of protecting devices and equipments to be installed at generator end on the interconnecting feeders would be informed to the STU/transmission licensee, by the generators. Similarly protective device / equipment provided on inter-connecting feeder by transmission licensee should be informed by transmission licensee to the generator.

6. Captive generators if having connectivity with STU system may have to pay parallel operation charges to the concerned licensee, as may be decided by the Commission from time to time.

7. The Intra-state user shall not force changes in maintenance schedules of utilities in the grid, due to constraints arising in his system during grid operation.

8. All generators (including CGP) will make adequate arrangement for isolation and islanding of their unit(s) in case of system distress conditions.

9. Depending on the requirement of the system, the generator/ captive generating plant will provide adequate reactive power to the system matching with the active power supply subject to the designed limitations of generator as specified by the manufacturer.

10. In case of low frequency, the total spinning reserve capacity available with the generators should be brought in to operation for maximizing their generation/ captive power generation.

11. Under extreme emergencies when captive generator is not injecting power, captive / non captive consumers may also liable to observe load shedding.

12. For scheduling and despatching of demand/drawal/bilateral exchanges etc, the CGPs will be treated at par with the other generators.

13. The Intra-state user shall take care of modification of equipment ratings, if any, of both his system and grid connection point equipments arising due to connectivity modification.

14. The Intra-state user shall satisfy protection standards and relay coordination aspects at the connection point as per overall grid norms..

15. The Intra-state user shall provide tele-metering, SCADA and transfer of other relevant data from the points of interconnection of concerned Intra-state user (s) to SLDC, to facilitate the grid operation.

16. The Intra-state user shall take care of his system in the event of grid initiated disturbances and not rely on grid defence mechanisms alone.

17. The Intra-state user shall ensure installation of sensitive and reliable protection system for fast opening of breaker and isolation of its installation from grid due to disturbances initiated from his system.

18. The Intra-state user shall take part in islanding and other grid schemes by contributing generation/load wherever available, as decided by the SLDC, The applicant shall follow load restoration guidelines during islanded operation as per instructions of the SLDC.

19. The Intra-state user shall help the grid by supplying start-up power if warranted by SLDC, in case it has generating sources in its area.

20. The Intra-state user shall provide relevant protection tripping data in the events of grid disturbances to SLDC for analysis and ensuring safe and reliable grid operation.

21. Grid shall help the Intra-state user in the event of his system failures, by way of assistance for start up power and restoration by SLDC.

22. The Intra-state user shall ensure safety standards and follow operating procedure during maintenance of common portion by other utility personnel, including line permits and allowing locking of isolator in open position to prevent accidental charging.

23. The intra state user shall ensure proper tele-metering, accessibility by express communication, so that grid inter-connectivity data is made available to all concerned.

24. The Intra-state user shall ensure that proper energy meters are installed as per provision in Chapter 8 of this code.

25. The licensee shall perform testing/calibration of equipments and energy meters at inter connection points in presence of interested parties and concerned utilities and make available test reports of such periodic testing to interested parties and concerned utilities/organizations including SLDC.

26. The Intra-state user shall plan maintenance schedule of their lines/inter connecting transformers (ICTs) or bay of inter connection line in consultation with the SLDC/STU.

27. In exceptional circumstances of system operation, SLDC will have the right of postponing a maintenance schedule in the Intra-state user's system if adverse conditions exist. This will however be an exception and not rule.

28. The Intra-state user shall satisfy such other prevalent norms of equipment and personnel safety, equipment protection and grid operation code, environment safety norms and such other national policies which are not listed here in this document.

29. The Intra-state user shall share information whenever his system adopts and follows higher than prescribed norms/standards in respect of equipment protection, grounding and other operation/protection standards and human safety as given by the STU and CEA so that grid and nation may benefit from the improved standards.

30. The Intra-state user shall not energize a dead utility connection unless permitted by SLDC.

4.5 Telemetry Requirements : -

4.5.1. All Intra-state users and Transmission Licensees including the State Transmission Utility shall provide the required facilities at their respective ends as specified in the Connection Agreement: Provided that the equipments/devices for communication and data exchange shall be provided considering the guidelines of STU & State Load Despatch Centre, the interface requirements and other such guidelines/specifications as applicable.

4.5.2 Reliable and efficient speech and data communication systems shall be provided to the SLDC to facilitate necessary communication and data exchange, and supervision/control of the State Grid by the State Load Despatch Centre, under normal and abnormal conditions.

4.5.3 It is the responsibility of the STU & Transmission Licensees, Intra-state users including the Distribution Licensees to provide the necessary system operation parameters as specified by the SLDC on real time / online basis making use of the state of the art technology (Data Acquisition & communication) for effective operation of the state grid in coordination with the regional grid.

4.5.4 SLDC shall ensure reliable communication channel with RLDC. SLDC shall install and maintain Voice logging systems for recording telephonic instructions and information.

4.5.5 Telemetry is required for 1 MW and above intra-State users seeking connection to intra-State transmission system or network of distribution licensee and also availing open access. These intra-State user shall provide necessary facilities for voice and data communication and transfer of online operational data such as voltage frequency, load flow etc. The state transmission utility or transmission licensee as the case may be shall install such infrastructure facilities for and at the cost of the intra-State user.

4.5.6 Station service load may require separate telemetry if it comes from a different Load Control Area. Telemetry of active and reactive power, energy (KW, KWh, KVAr, KVArh), Voltage(KV) and other parameters such as Breaker status & Control etc is normally required.

4.6 Safety

At the point of interconnection to the grid an isolating device, which is typically an isolator/disconnect switch, shall be provided that physically isolates the grid from the project. Safety and operating procedures for the isolating device shall be in compliance with the standards of safety as laid down by the Central Electricity Authority under Section 73(c) of the Act. The isolating device may be placed in a location other than the point of interconnection, by agreement of STU and affected parties. In any case the device:

1. must simultaneously open all phases (gang-operated) to the project/Intra-state user;
2. must be accessible to STU and under ultimate SLDC jurisdiction;
3. must be lockable in the open position by STU;
4. would not be operated without advance notice to either party, unless an emergency condition requires that the device be opened to isolate the project;
5. must be suitable for safe operation under the conditions of use; and
6. may be locked by STU personnel in the open position and install safety boards:
    i. if it is necessary for the protection of maintenance personnel when working on de-energized circuits;
    ii. if the project/Intra-state user or STU equipment presents a hazardous condition;
    iii. if the project/Intra-state user or STU equipment interferes with the operation of the grid;
    iv. if the grid interferes with the operation of the project/Intra-state user.

Since the device is primarily provided for safety and cannot normally interrupt load current, consideration shall be given as to the capacity, procedures to open, and the location of the device.

4.7 Other Considerations

4.7.1 **Equipment for Grid connectivity of generating unit** shall be in conformity with the following requirements:

The overall system shall be designed considering maximum voltage variation of +/- 5% and fault level of 40KA for 400KV system.

Frequency variation shall be +3 to -5% and Equipment shall be suitable for 50 ^{0}C ambient.

1. For Generator:

Voltage Variation	±7.5% continuously at rated power factor. Reduced MVA operation at 110% of the rated voltage.
Frequency Variation	47.5 HZ. To 51.5. Hz.
Combined voltage and frequency variation	± 5%
Power Factor variation	0.85 (lag) to 0.95 (lead)
Operation under unbalanced load	As specified in IEC 34-1
Short circuit ratio	As per IEC 34-1
Operation under unsymmetrical short circuit	Negative sequence current $\mathbf{I_2}$ expressed in per unit of rated current for a duration of 't' second such that the value of($\mathbf{I_2})^2\mathbf{t}$ shall comply to IEC 34-1
Voltage Wave form	The total harmonic factor (T.H.F.) shall be within the limit specified in IEC 34-1
Short Circuit withstanding capacity	Capable of withstanding of 3 phase short circuit at the generator terminals when operating at rated MVA and power factor with 5% over voltage for a period of not less than 3 seconds.
Special operating conditions	Capable of withstanding the electrical mechanical and thermal stresses developed during fast reclosing of high voltage line, transmission line switching, faults, out of step operation and out of phase synchronization etc.
Line charging capability	Not less than 30% of its rated MVA at zero pf.

2. For Excitation System:

i) Characteristics: The excitation system shall have matching characteristics suitable for satisfactory parallel operation with other generator in the plant.

ii) Equipment design and sizing criteria:

General	When the generator is subjected to a sudden loss of rated output at rated power factor, the system shall be capable of restoring the voltage of within 2% of the nominal preset value within negligible time, so as not to initiate the protection equipment.
b) Excitation system response time as per IEEE 421 A	<0.5 sec.
c) Excitation response ratio	>2
d) Excitation system ceiling voltage	> 1.5 times rated load excitation voltage
e) Field forcing capability	Each excitation system channel shall be capable of supplying without damage to any of the components, the field forcing voltage and current of the system for a period of 10 seconds without exceeding the limits of temperature
f)Power System Stabilizer	Power System Stabilizers (PSS) shall be suitable for damping the various models of electro-mechanical oscillations at all frequencies in the range of 0 to 3 Hz. under varying generator loading and power system network considerations. PSS shall be adaptive to varying operating conditions with features to compute optimum stabilizing signal along with suitable scheme for identifying external reactance of the generator. Facility for remote manual switch off-on alongwith indication shall be incorporated. Automatic supervision and blocking/switch off facility alongwith indications etc. shall be provided.
g) Rotor angle limiter	A rotor angle limiter shall be incorporated in the system. This shall enable to keep the angle between the direct axis of the machine and network vector within the set reference value as determined by stability by adjusting the excitation.
h)Stator current limiter	The stator current limiter shall act immediately in under excited range. The time delay in over excited range shall enable a temporary overloading of the machine.

i) Rotor current limiter	The regulator shall act with time delay, so that the regulation dynamics are not impaired in case of a fault
j) Voltage/frequency(V/Hz) limiter	To limit the ratio of generator voltage and frequency at all operating conditions to such a value that the maximum generator transformer core flux density does not exceed the value specified
k) HV Switchyard should be suitable for the following parameters	
i) X/R Ratio of the system	14
ii) Design BIL (Basic Insulation Level)	400kV 220kV 132kv 1425kVp 1050 kVp 650kVp
iii) Lightning Arrester voltage rating in kVrms	336, 198, 120
iv) Requirement of protection	Main-I & Main-II distance protection on outgoing lines.
v) Requirement of metering	0.2S accuracy metering class
vi) Requirement of load shedding, islanding	Required
vii) Earth mat design criteria	40 kA 1 sec.

Existing electrical equipment in the STU system, such as transformers, power circuit breakers, disconnect switches, arresters and line conductors shall be installed based on the duties expected in response to system additions identified in long-term plans. However, with the interconnection of a new generating resource, some equipment may become under-rated and need to be replaced.

4.7.2 System Stability and Reliability

The STU system is developed with careful consideration for system stability and reliability during disturbances. The size of the project, breaker configurations, generator characteristics, and the ability to set protective relays will affect where and how the point of interconnection is made. The project may also be required to participate in special protection schemes (remedial action) such as load dropping.

4.7.3 Control and Protection

STU coordinates its protective relays and control schemes to provide for personnel safety and equipment protection and to minimize disruption of services during disturbances. Project interconnection usually requires the addition or modification of protective relays and/or control schemes. New projects must be compatible with existing protective relays schemes. Sometimes, the addition of voltage transformers (VTs), current transformers (CTs), or pilot scheme (transfer trip) also are necessary, based on the point of Interconnection.

4.7.4 **Dispatching and Maintenance**

SLDC operates the grid to provide reliable customer service while meeting the seasonal and daily peak loads even during equipment outages and disturbances. Project integration requires that the equipment at the point of interconnection not restrict timely outage coordination, automatic switching or equipment maintenance and scheduling. Reliable service may require additional switchgear, equipment redundancy, or bypass capabilities at the point of interconnection for acceptable operation of the system.

The generator is expected to supply up to maximum available reactive capability and / or to adjust generation levels including reducing to zero if required by the SLDC. This will always be for reliability purposes only in exigencies.

4.7.5 **Atmospheric and seismic conditions**

The effects resulting from windstorms, floods, lightning, elevation, temperature extremes and earthquakes must be considered in the design and operation of the project. The Intra-state user(s) will be responsible for determining that the appropriate standards, codes, criteria, recommended practices, guides and prudent utility practices are met with.

4.8 Site responsibility schedule

4.8.1 For every connection to the licensees system a site responsibility schedule shall be prepared in accordance with CEA Regulations and CSERC OA Regulations/ detail procedure approved by the Commission.

4.8.2 **Single Line Diagrams**

1. Single Line Diagram shall be furnished for each Connection Point by the Intra-state users to STU and SLDC. These diagrams shall include all HV / EHV connected equipment and the connections to all external circuits and incorporate numbering, nomenclature and labeling, etc. The diagram is intended to provide an accurate record of the layout and circuit connections, rating, numbering and nomenclature of HV / EHV apparatus and related plant.
2. Whenever any equipment has been proposed to be changed, then concerned intra state user shall intimate the necessary changes to STU and to all concerned. When the changes are implemented, changed Single Line Diagram shall be furnished by the agency to SLDC/STU.

4.8.3 Site Common Drawings

i) Site Common Drawing will be prepared for each Connection Point and will include site layout, electrical layout, details of protection and common services drawings. Necessary details shall be provided by the Intra-state users to STU.

ii) The detailed drawings for the portion of the Intra-state user and STU/transmission licensee at each Connection Point shall be prepared individually and copies shall be exchanged between Intra-state user and STU.

iii) If any change in the drawing is found necessary, the details will be exchanged between Intra-state users and STU as soon as possible.

4.9 System Performance:

4.9.1 The design and construction of all the equipment connected to the transmission system shall satisfy the relevant Indian standard specifications. In case of equipment for which the Indian Standard Specifications do not exist, the appropriate IEC, or IEEE or other International Standards shall apply.

4.9.2 Installation of all electrical equipment shall comply with Standards/Regulations of CEA which are in force for the time being and will be replaced by new Standards/Regulations accordingly.

4.9.3 For every new connection sought, the transmission licensee shall specify the connection point/interface point and the supply voltage, alongwith the metering requirements as specified in the Metering Code.

4.9.4 **Supervisory control and data acquisition (SCADA)**: The transmission licensee shall install and make operative an operational metering data collection system under SCADA for storage, display and processing of operational metering data. All Intra-state users shall make available outputs of their respective operational meters to the SCADA interface equipment for display at the SLDC.

4.10 Protection requirement:

Intra-state users and transmission licensee shall follow protection system and coordination as specified in part-I of CEA (Technical Standards for Connectivity to the Grid) Regulations, 2007 for grid connectivity. They should also abide with protection functions mentioned in schedules of CEA (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations, 2010. These are also specified in chapter of protection code in this code.

4.11 Metering Requirement: Transmission Metering code as depicted in Chapter 8 of this code shall be applicable to user of State transmission system. The metering requirements shall be strictly in accordance with the CEA (Installation and Operation of meters) Regulations, 2006 and its amended Regulation, 2010 under Section 55 of the Act with regard to installation & operation of meters. Location of metering point shall be as per provision in CSERC (Connectivity and Intra-State Open access) Regulations, 2011 as amended from time to time.

4.12 Reactive Power Compensation

4.12.1. "Reactive Power compensation and/or other facilities shall be provided by Intra-state users, as for as possible, in the areas prone to low or high voltages systems thereby avoiding the need for exchange of Reactive Power to/from the Intra-STS and to maintain the IntraSTS voltage within the specified range at all times. Their healthiness and operation as per real time requirement shall be ensured by the Intra-state user and STU."

4.12.2. Line Reactors may be provided to control temporary over voltage within the limits as set out in connection agreements.

4.12.3. The reactive compensation to be provided by the Intra-state user if any at the time of connectivity shall be indicated by State Transmission Utility in the Connection Agreement for implementation.

4.12.4. Switching in/out of all 400 kV bus and line Reactors throughout the grid shall be carried out as per instructions of State Load Despatch Centre. Tap changing on all 400/220 kV Interconnecting Transformers shall also be done as per the instructions of State Load Despatch Centre only.

4.13 Inadvertent Flow: When two systems are operating in parallel with floating tie-line, it may not be possible to have tie line absolutely floating because of dynamics of network parameters and there will be a flow of energy from one system to another system. Such inadvertent flow shall be accounted for the purpose of commercial billing.

4.14 Right to reject an application:

4.14.1 An incomplete application, and/or an application not found to be in conformity with the Regulations and Procedures approved by the Commission, shall be rejected.

The transmission licensee may reject any application for connection to and/or use of the transmission system under the following conditions:-

1. If the proposed connections violate any provisions under the transmission license.

2. If the proposed works stated in the application do not come within the purview of the licensee or do not conform to the provisions of this Grid Code and CEA Regulations issued u/s 177 of the Electricity Act, 2003.

3. If the system capacity does not permit.

4.14.2 In the event of an offer becoming invalid or rejected within the validity period, no further action shall be taken by the STU/transmission licensee on the connection applications unless it is substantially different from the original application with regard to the system changes.

4.15 Connection Agreement

4.15.1 Connection Agreement shall include, as appropriate, within its terms and conditions, the following information relating to the connection of the User or Transmission Licensee to the STS:

(i) a condition requiring both parties to comply with the State Grid Code, Indian Electricity Grid Code specified by CERC if applicable and all other regulations concerning Standards of Grid Connectivity, Safety and security notified by the Authority

(ii) details of connection, technical requirements and commercial arrangements;

(iii) details of any capital expenditure arising from necessary reinforcement or extension of the system, data communication etc and demarcation of the same between the concerned parties;

(iv) Site Responsibility Schedule;

(v) General philosophy and guidelines on protection;

(vi) Protection systems;

(vii) System recording instruments;

(viii) Communication facilities; and

(ix) Any other information considered appropriate by the State Transmission Utility or the Commission.

4.15.2 STU shall develop a model Connection Agreement as mentioned in CSERC (Connectivity and Intra-State Open access) Regulation, 2011. STU shall inform the progress of new projects inter-connecting with ISTS in advance to enable CTU to coordinate installation of meters, SCADA data integration, speech and protection etc.

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CHAPTER - 5

OPERATING CODE

5.1 Operation Policy:

1. The primary objective of integrated operation of the State grid is to enhance the overall operational economy and reliability of the entire electric power network spread over the geographical area of the State. The operation of the transmission system shall be consistent to IEGC, 2010 and its modification(s), if any. The Intra-state user shall however be subject to the grid discipline prescribed by the SLDC.

2. Overall real time operation of the State grid shall be supervised by the SLDC. The role of SLDC and STU shall be in accordance with the provisions of the Act and CSERC (Intrastate open access and connectivity) Regulations, 2011.All intra State entities shall comply with these operational guidelines and coordinate with each other, for deriving maximum benefits from the integrated operation and for equitable sharing of obligations. Every generating company and transmission licensee shall provide written operating instructions for each equipment and operating procedure for sequence of operations of power system equipment in their control room. The operating instructions followed shall not be inconsistent with the manufacturer's instructions. The operating instructions and procedures may be revised by the generating company or transmission licensee, as the case may be.

3. A set of detailed internal operating procedures for the State grid shall be developed and maintained by the SLDC in consultation with the intra State entities, RLDC which shall be consistent with State Grid Code and IEGC, 2010 and its amendments. These internal operating procedures shall include the following:

   i. Black start procedures.

   ii. Load shedding procedure as approved by the Commission.

   iii. Islanding procedure.

   iv. Any other procedure considered appropriate by the State Load Despatch Centre.

   All operational instructions given by Regional Load Despatch Centres and State Load Despatch Centres through telephone, Fax, e-mail, etc shall be given a unique operating code number. State Load Despatch Centre shall maintain a voice recorder for recording and reproduction of conversation with time tag or stamp. The record of instructions shall be kept for at least six months.

4. The control rooms of the SLDC, Power Plants and EHV sub-stations and any other control centres of all State entities shall be manned and maintained round the clock by qualified personnel with adequate training.

5.2 System Security Aspects:

1. All Intra-state user(s) and all the other constituent participating in the State grid shall endeavour to operate their respective power systems and power stations in synchronous with each other at all times, such that the entire system within the State operates as one synchronized system.

2. No part of the grid shall be deliberately isolated from the rest of the State grid, except:

   (i) Under an emergency, and conditions in which such isolation would prevent a total grid collapse and / or enable early restoration of power supply;

   (ii) when serious damage to a costly equipment is imminent and such isolation would prevent it; and

   (iii) when such isolation is specifically instructed by SLDC.

   Complete synchronization of grid shall be restored as soon as the conditions again permit it. The restoration process shall be supervised by SLDC, as per operating procedures separately formulated.

3. Any tripping, whether manual or automatic, of any of the above elements of State grid shall be precisely intimated by the concerned intra state users to SLDC as soon as possible. The reason (to the extent determined) and the likely time of restoration shall also be intimated.

4. All generating units, which are synchronized with the State grid irrespective of their ownership, type and size, shall have their governors in normal operation at all times. If any generator of over 50 MW rating is required to be operated without its governor in normal operation the SLDC shall be immediately informed about the reason and duration of such operation. All governors shall have a droop between 3% and 6%. All provisions related to Free Governor Action, shall be consistent with relevant provisions as provided in the IEGC specified by CERC under clause (h) of Section 79 of the Act and amended from time to time.

5. Facilities available in load limiters, automatic turbine run up system (ATRS), turbine supervisory control, coordinated control system, etc., shall not be used to suppress the normal governor action in any manner. No dead bands and/or time delays shall be deliberately introduced.

6. All generation units, operating at/up to 100% of their maximum continuous rating (MCR) shall normally be capable of (and shall not in any way be prevented from) instantaneously picking up five percent (5%) extra load for at least five (5) minutes or within technical limits prescribed by the manufacturer when frequency falls due to a system contingency. The generating units operating at above 100% of their MCR shall be capable of (and shall not be prevented from) going at least up to 105% of their MCR when frequency falls suddenly. Any generating unit of over fifty (50) MW size, not complying with the above requirement, shall be kept in operation (i.e., synchronized with the State grid) only after obtaining the permission of SLDC. However, the entity can make up the corresponding shortfall in spinning reserve by maintaining an extra spinning reserve on the other generating units of the entity.

7. The recommended rate for changing the governor setting, i.e. supplementary control for increasing or decreasing the output (generation level) for all generating units, irrespective of their type and size, would be one (1.0) percent per minute or as per manufacturer's limits. However, if frequency falls below 49.7 Hz or as decided by CERC from time to time, all partly loaded generating units shall pick up additional load at a faster rate, according to their capability.

8. Except under an emergency, or to prevent an imminent damage to personnel and equipment, no entity shall suddenly reduce his generating unit output by more than fifty (50) MW without prior intimation to, and consent of the SLDC, particularly when frequency is falling or is below 49.5 or as decided by CERC from time to time. Similarly, no entity shall cause sudden increase in its load by more than fifty (50) MW without prior intimation to and consent of the SLDC.

9. All generating units shall normally have their Automatic voltage regulator (AVRs) in operation, with appropriate settings. In particular, if a generating unit of over fifty (50) MW size is required to be operated without its AVR in service, the SLDC shall be immediately intimated about the reason and duration, and its permission obtained. Power System Stabilizers (PSS) in AVRs of generating units (wherever provided), shall be got properly tuned by the respective generating unit owner as per a plan prepared for the purpose by the CTU / STU from time to time. CTU / STU will be allowed to carry out checking of PSS and further tuning it, wherever considered necessary.

10. Provision of protections and relay settings shall be coordinated periodically throughout the State grid, as per a plan to be separately finalized by the STU in coordination with all entities.

11. All Intra-state user(s) shall make all possible efforts to ensure that the grid frequency always remains within the 49.5–50.2 Hz band as per IEGC, 2010 as amended from time to time. However, generator should have operating capability to give MCR output under Grid Frequency Variation of -5% to +3% (47.5 to 51.5) as per CEA technical standard.

12. All Intra-state user(s) shall provide automatic under-frequency & df/dt load shedding in their respective systems, to arrest frequency decline that could result in a collapse/disintegration of the grid, as per the plan separately finalized by STU, and shall ensure its effective application to prevent cascaded tripping of generating units in case of any contingency. All State entities shall ensure that the under-frequency & Df/Dt load shedding/islanding schemes are functional and no under-frequency relay is by-passed or removed without prior consent of SLDC.

13. All Intra-state user(s) shall facilitate identification, installation and commissioning of the systems protection schemes (SPS) (including inter-tripping and run-back) in the power system to operate the transmission system closer to their limits and to protect against situations such as voltage collapse and cascade tripping, tripping of important corridors/flow-gates etc.. .Such schemes would be finalized by the STU and shall always be kept in service. If any SPS is to be taken out of service, permission of SLDC shall be obtained indicating reason and duration of anticipated outage from service.

14. All generating units will ensure HT/LT by-pass arrangement wherever provided to be in service so, that at least one of the generator remaining in service for house load.

15. Procedures shall be developed by SLDC in consultation with RLDC to recover from partial/total collapse of the grid in accordance with CEA (Grid Standards) Regulation as and when the same comes into force and periodically update the same in accordance with the requirements given under section 5.8 of IEGC Regulation, 2010. These procedures shall be followed by all the Intra-state users, STU and, SLDC to ensure consistent, reliable and quick restoration.

16. The Intra-state user(s) and STU shall send information / data including disturbance recorder / sequential event recorder output etc., to SLDC for purpose of analysis of any grid disturbance / event. No Intra-state user(s) shall block any data/information required by the SLDC for maintaining reliability and security of the grid and for analysis of an event.

17. All Intra-state user(s), STU and SLDC shall make all possible efforts to ensure that the Steady state grid voltage always remains as follows as per IEGC, 2010:

Voltage - (kV rms)		
Nominal	Maximum	Minimum
765	800	728
400	420	380
220	245	198
132	145	122
33	36	30

The licensee shall design and operate a distribution system in conjunction with the transmission systems. The licensee shall not permit the voltage at the point of supply to the consumer to vary from the declared voltage which is:

(a) In the case of low or medium voltage, by more than 6%; or

(b) In the case of high voltage, by more than 6% on the higher side or by more than 9% on the lower side; or

(c) In the case of extra high voltage, by more than 10% on the higher side or by more than 12.5% on the lower side.

Any exception to the above will only be allowed with the written consent of the consumer or with prior approval of the Commission.

18. Intra-state user shall ensure to maintain following temporary over voltage level due to sudden load rejection and voltage unbalance :-

S.No.	Nominal System Voltage (kV rms)	Phase to Neutral Voltage (kV peak)	Voltage unbalance (%)
1	765	914	1.5
2	400	514	1.5
3	220	283	2
4	132	170	3

The voltage unbalance i.e. difference of voltage between any two phases on 33 kV system should not exceed 3% at supply point.

19. All the consumer availing 3 phase supply shall balance their load in such a way that difference in loading between each phase does not exceed 5% of average loading between phases.

20. The maximum permissible limit of harmonics as specified in Institute of Electrical and Electronics Engineers (IEEE) standard 519 (1992) adopted in clause (5) of part-II of Central Electricity Authority (Technical standard of connectivity to the grid) Regulations 2007 (hereafter CEA (Technical Standard Regulations) is as follows:

(a) Voltage distortion limit – Utilities responsibility

Bus Voltage	Maximum individual voltage distortion	Total maximum voltage distortion
33KV & 132 KV	3.0	5.0
220KV	2.0	2.5
400KV	1.5	2.0

(b) Current distortion – Intra-state users responsibility

The total harmonics distortion for current drawn from the transmission system at the connection point shall not exceed 8%.

21. 400/220 kV & 220/132 kV I.C.T's. tap operation will be done only after approval from SLDC. .

22. Any switching operation on 400 kV will be done after intimation & approval by WRLDC/SLDC as the case may be.

23. STU, transmission licensee shall provide adequate voltage control measures through voltage relay and shall ensure its effective application to prevent voltage collapse.

24. Hydro generators having capability to operate in condenser mode are required to do so under instructions from SLDC. Hydro generators having capability to operate in Pump mode are required to do so under instructions from SLDC.

25. SLDC shall make all out efforts to evacuate the available solar, small hydro and wind power and treat them as a must-run station. However, system operator may instruct the solar, small hydro and /wind generator to back down generation only on consideration of grid security or safety of any equipment or personnel is endangered and solar, small hydro and wind generator shall comply with the same. For this, Data Acquisition System facility shall be provided for transfer of information to SLDC.

26. SLDC may direct a wind generators to curtail its VAr draw/injection in case the security of grid or safety of any equipment or personnel is endangered.

27. During the wind generator start-up, the wind generator shall ensure that the reactive power drawl (inrush currents of induction generators) shall not affect the grid performance.

5.3 Demand Estimation for Operational Purposes:

(a) The demand estimation both active power and reactive power is to be done on daily/weekly/monthly/yearly basis by SLDC for current year for load - generation balance planning. The SLDC shall carry out system studies for operational planning purposes using this demand estimate.

(b) SLDC shall develop methodologies/mechanisms for estimation of daily/weekly/monthly/ yearly demand estimation (MW, MVAr and MWh). Based on this demand estimate and the estimated availability from different sources, SLDC shall plan demand management measures like load shedding, power cuts, etc. and shall ensure that the same is implemented by the distribution licensees. Distribution licensees shall abide by the demand management measures of the SLDC and shall also maintain historical database for demand estimation.

(c) SLDC shall carry out demand estimation from the historical data and weather forecast data from time to time. Distribution licensees and other concerned persons shall provide relevant data and other information as required by SLDC for demand estimate.

(d) The demand estimation for operational purposes is to be done on a daily/weekly/monthly basis by SLDC. Mechanisms and facilities at SLDC shall be created to facilitate on-line estimation of demand for daily operational use for each 15 minutes block.

(e) The SLDC shall take into account the Solar and Wind Energy forecasting also to meet the active and reactive power requirement.

5.4 Demand Management:

This section is concerned with the provisions to be made by SLDC to effect a reduction of demand in the event of insufficient generating capacity, and inadequate transfers from external interconnections to meet demand, or in the event of breakdown or congestion in intra-state or inter-state transmission system or other operating problems (such as frequency, voltage levels beyond normal operating limit, or thermal overloads, etc.) or overdrawl of power vis-à-vis of the regional entities beyond the limits mentioned in UI regulation of CERC.

1. **Demand Disconnection: -**

(i) The Intra-state user(s) shall endeavour to restrict their net drawal from the grid within their respective drawal schedules whenever the system frequency is below 49.7 Hz., When the frequency falls below 49.5 Hz., requisite load shedding

(manual) shall be carried out to curtail the overdrawal. Such load shedding shall be pre-planned for each level of under frequency.

(ii) Further, in case of certain contingencies and/or threat to system security, the SLDC may direct sub-stations to decrease its drawal by a certain quantum. Such directions shall immediately be acted upon.

(iii) Each Intra-state user(s) shall make such arrangements as will enable manual demand disconnection to take place, as instructed by the SLDC, under normal and / or contingent conditions.

(iv) The measures taken to reduce the Intra-state user(s) drawal from the grid shall not be withdrawn as long as the frequency/voltage remains at a low level, unless specifically permitted by the SLDC.

(v) All Intra-state users, distribution licensee or bulk consumer shall comply with direction of SLDC and carry out requisite load shedding or backing down of generation in case of congestion in transmission system to ensure safety and reliability of the system. The procedure for application of measures to relieve congestion in real time as well as provisions of withdrawal of congestion shall be in accordance with Central Electricity Regulatory Commission (Measures to relieve congestion in real time operation) Regulations, 2009 as amended from time to time.

2. Load Shedding Policy:

i. In case of shortage of power availability with respect to demand, the SLDC shall resort to shedding on different load catering feeders on economic principle in consultation with DISCOM till the Commission specifies any policy/order in this regard.

ii. In case of certain contingencies and/or threat to system security, the SLDC may direct any Intra-state user to decrease drawal of its control area by a certain quantum. Such directions shall immediately be acted upon.

iii. SLDC will monitor and regulate the same.

5.5 Periodic Reports:

A weekly report shall be issued by SLDC to STU and shall cover the performance of the State grid for the previous week. The weekly report shall contain the following:

(i) Frequency profile: maximum and minimum frequency recorded daily and daily frequency variation index (FVI);

(ii) voltage profile: the voltage profile of selected sub-stations;

(iii) major generation and transmission outages;

(iv) transmission constraints; and

(v) instances of persistent/significant non compliance of the Grid Code.

5.6 Other Reports:

The SLDC shall also prepare a quarterly report which shall bring out the system constraints, reasons for not meeting the requirements, if any of security standards and quality of service, along with details of various actions taken by different intra state users, and the intra state users responsible for causing the constraints. SLDC shall also prepare quarterly energy balance of STU, CSPDCL and other transmission licensee and submit to concern and the Commission.

5.7 Operational Liaison:

This section sets out the requirements for the exchange of information in relation to operations and / or events on the total grid system related to :

i. the State grid;

ii. inter-State links; and

iii. the system of intra-State entity.

The above generally relates to notifying of what is expected to happen or what has happened. The operational liaison function is a mandatory built-in hierarchical function of the SLDC and Intra-state user(s), to facilitate quick transfer of information to operational staff. It will correlate the required inputs for optimization of decision-making and actions.

5.7.1 **Procedure for Operational Liaison :**

1. **Operations and events on the State grid:**

Before any operation is carried out on State grid, the SLDC will inform each entity, whose system may, or will experience an operational effect, and give details of the operation to be carried out. Immediately following an event in the State grid, the SLDC will inform each Intra-state user, whose system may, or will experience an operational effect, following the event, details of what has happened in the event.

2. **Operations and events on an Intra-state user(s) system:**

Before any operation is carried out on an Intra-state user(s) system, the Intra-state user(s) will inform the SLDC, in case the State grid may, or will experience an operational effect, and give details of the operation to be carried out. Immediately following an event on the Intra-state user(s) system, the Intra-state user(s) will inform the SLDC, in case the State grid may, or will, experience an operational effect following the event and give details of what has happened in the event.

For recharging of tripped ICT 400/220 kV or 220/132 kV, the permission from the designated authority of STU shall be obtained by SLDC.

5.8 Outage Planning:

5.8.1 **General:**

1. This part sets out the procedure for preparation of outage schedules for the elements of the State grid in a coordinated and optimal manner keeping in view the State system operating conditions and the balance of generation and demand. List of elements of grid covered under these stipulations shall be prepared and be available with SLDC.

2. The objective of this sections are:

   i. To produce a coordinated generation outage programme for the State grid, considering all the available resources and taking into account transmission constraints, as well as seasonal requirements.

   ii. To minimize surplus or deficits, if any, in the system requirement of power and energy and help to operate the system within security standards.

   iii. To optimize the transmission outages of the elements of the State grid without adversely affecting the grid operation but taking into account the generation outage schedule, outages of constituent systems and maintaining system security standards.

3. The generation output and transmission system should be adequate after taking into account the outages to achieve the security standards.

4. Outage planning is prepared in advance for the current year and reviewed during the year on quarterly and monthly basis.

5.8.2 Outage Planning Responsibilities:

1. The SLDC is responsible for analyzing the outage schedule given by all State entities, preparing a draft outage schedule for next year and establishment of final plan for current year by July of current year.

2. The outage plan will be reviewed by the STU.

3. Demand estimation is necessary for both long time scale to ensure adequate system plant margins and ratings and for short time scale to assist with frequency control. Discom shall provide to the STU their estimates of demand for the desired period on a year ahead, month ahead basis as required. Based on this, the STU shall make monthly peak and lean period demand estimates for the year ahead. STU shall use hourly generation summation figures and import/export figures to meet the demand estimation. Distribution companies shall provide to SLDC estimated load that may be shed, when required, in discrete blocks with the details of the arrangements of such load shedding. All data shall be collected in accordance with procedures agreed between the STU and each constituent. SLDC shall maintain a database of State demand on an hourly basis.

5.8.3 Outage Planning Process:

1. The STU and generating plants shall provide the SLDC their proposed outage programs in writing for the next year by the end of the month of August of the current year. These shall contain identification of each generation unit / line/ICT, the preferred date for each outage and its duration and where there is flexibility, the earliest start date and latest finishing date.

2. SLDC shall then come out with a draft outage program for the next year by the end of the month of September of the current year for the State grid taking into account the available resources in an optimal manner and to maintain security standards. This will be done after carrying out necessary system studies and, if necessary, the outage program shall be rescheduled. Adequate balance between generation and load is to be ensured while finalizing outage program.

3. Transmission outage planning shall be harmonized with Generator outage planning and distribution system outage planning shall be harmonized with generation and transmission outage planning.

4. This next year plan shall be intimated to all Intra-state user(s) for implementation latest by the end of the month of January or by such earlier date as may be decided by STU.

5. This next year's plan shall be reviewed by SLDC/STU on quarterly and monthly basis in coordination with all parties concerned

6. In case of emergency in the system viz. loss of generation, break down of transmission line affecting the system, grid disturbance, system isolation, SLDC may conduct studies again before clearance of the planned outage.

7. SLDC is authorized to defer the planned outage in case of any of the following:

   (i) Major grid disturbance;

   (ii) system isolation;

   (iii) black out in system of any constituent; and

   (iv) any other event in the system that may have an adverse impact on the system security by the proposed outage.

8. Each intra-state user shall obtain the final approval from SLDC prior to availing an outage.

5.9 Recovery Procedures:

1. Detailed plans and procedures for restoration of the grid under partial / total black out shall be developed by SLDC in consultation with all intra-State users and shall be reviewed / updated annually.

2. Detailed plans and procedures for restoration of each constituent's system after partial / total black out within state, will be finalized by the concerned user in coordination with the SLDC.

3. List of generating plants with black start facility, inter-state synchronizing points and essential loads to be restored on priority, should be prepared and be available with SLDC.

4. The SLDC is authorized during the restoration process following a black out, to operate with reduced security standards for voltage and frequency as necessary in order to achieve the fastest possible recovery of the grid.

5. The recovery procedure shall be reviewed, confirmed and/or revised once every subsequent year. Training programs including workshops and simulation exercises of the procedure for different sub-systems may be carried out by the State Load

Despatch Centre, in coordination and consultation with Intra-state users and Transmission Licensees.

6. All communication channels required for restoration process shall be used for operational communication only, till grid normalcy is restored.

5.10 Event Information:

This part deals with reporting procedures in writing of reportable events in the system to all Intra-state user(s) and SLDC. The objective of this section is to define the incidents to be reported, the reporting route to be followed and information to be supplied to ensure consistent approach to the reporting of incidents/events.

5.10.1 **Responsibility**:

Any tripping of generating unit or transmission element of intra-State transmission system should be reported by Intra-state user to SLDC along with relay indication in addition to reportable events. The SLDC shall be responsible for reporting events to the STU. All Intra-state users shall collect necessary data for reporting to SLDC for monitoring and event analysis.

5.10.2 **Reportable Events**:

Events effecting a generator capacity or a load of more than (200) MW shall be reported by State Load Despatch Centre along with brief detail of the eventto the STU:

(i) Violation of security standards.

(ii) Operational Indiscipline.

(iii) Non-compliance of instructions.

(iv) System islanding / system black out.

(v) State black out / partial system black out.

(vi) Major protection failure.

(vii) System instability.

(viii) Tripping of any element of the EHV State grid.

(ix) Major Equipment failure.

5.10.3 **Reporting Procedure**:

(i) **Written reporting of events by intra-State entities to SLDC.**

In the case of an event which was initially reported by an intra state user to SLDC orally, the user will give a written report to SLDC in accordance with provision of this section.

(ii) **Written reporting of events by SLDC to intra-State users**

In the case of an event which was initially reported by SLDC to a user orally, the SLDC will give a written weekly report to the user in accordance with this section.

5.10.4 **Form of Written Reports**:

A written report shall be sent to SLDC or a Intra-state user(s), as the case may be, and will confirm the oral notification together with the following details of the event:

(i) Time and date of event.

(ii) Location

(iii) Plant and / or Equipment directly involved

(iv) Description and cause of event

(v) Demand and / or Generation (MW) interrupted and duration

(vi) All relevant system data including copies of records of all recording instruments including Disturbance Recorder, Event Logger, DAS etc.,

(vii) Sequence of trippings with time.

(viii) Details of Relay Flags.

(ix) Remedial measures.

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CHAPTER - 6

SCHEDULING AND DISPATCH CODE

6.1 This section deals with the procedures to be adopted for scheduling of the net injection / drawals of concerned intra-state users on a day ahead basis with the modality of the flow of information between the SGS/ InSGS/ SLDCs/ beneficiaries/ bulk consumer and other intra-state users. The procedure is specified for submission of capability declaration (Injection schedule) by each SGS/InSGS and submission of requisition / drawal schedule by beneficiary/bulk consumers and other intra-state users so as to enable SLDC to prepare the despatch schedule for SGS /InSGS and drawal schedule for each intra-state user. It also provides methodology of issuing real time despatch/drawal instructions and rescheduling, if required, to intra-state users along with the commercial arrangement for the deviations from schedules, as well as, mechanism for reactive power flow:

These guidelines are applicable to STU, SLDC and transmission licensee. These guidelines are also applicable to following users availing long-term and medium-term intra-State open access:

a) State generating station

b) Intra-state generating station (other than renewable based generating plant)

c) Central sector generating plants located in the State as specified in clause no. 6.4 in CERC (Indian Electricity Grid Code) Regulations, 2010,

d) Beneficiaries

e) Bulk consumers

The scheduling and dispatch procedure specified in this code shall not be applicable to the any users availing short-term intra-state or short term inter state open access but shall be applicable to intra state long and medium term open access customer. Long, medium and short –term inter-State open access shall be regulated by IEGC and CERC inter-state open access regulation as amended from time to time. For drawal of power from central sector generating station and for transfer of power to inter-state grid SLDC shall follow IEGC and co-ordinate with WRLDC.

6.2 Responsibility of Scheduling and Dispatch

6.2.1. SLDC shall have the total responsibility for

(i) Scheduling/ dispatching of state generating station;

(ii) Scheduling drawal from the ISGS (within their share in the respective plant's expected capability);

(iii) Regulating the demand of the beneficiaries in the State;

(iv) Regulating the bilateral /collective interchanges, if any;

(v) Regulating the net drawal of their control area from the regional grid in accordance with respective regulation of the CERC;

(vi) Regulate the injection / drawal of open access customer connected with State grid.

(vii) Regulate InSGS

(viii) To maintain the State UI account / collection and disbursement of UI payment of users/Intra State users.

(ix) To maintain State Energy Accounts.

6.2.2. The beneficiaries through SLDC shall always endeavor to restrict its net drawal from Central generating stations and other generating plants within their respective drawal schedules.

6.2.3. The State generating station, InSGS shall be responsible for power generation generally according to the daily schedule advised to them by the SLDC on the basis of the drawal schedules received from the beneficiaries/bulk consumers. However, the generating plants may deviate from the given schedules depending on the plant and system conditions. In particular, they would be allowed / encouraged to generate beyond the given schedule under deficit conditions. Deviations from the ex-bus generation schedules shall be appropriately priced by Commission.

Provided that when the frequency is higher than 50.2 Hz, the actual net injection shall not exceed the scheduled dispatch for that period. Also while the frequency is above 50.2 Hz, the generating plants may (at their discretion) back down without waiting for an advice from SLDC to restrict the frequency rise. When the frequency falls below 49.7 Hz, the generation at all stations (except those on peaking duty) shall be maximized, at least up to the level which can be sustained, without waiting for an advice from SLDC. Notwithstanding the above, the SLDC may direct the generating plants/beneficiaries to increase/decrease their generation/drawal in case of contingencies e.g. overloading of lines / transformers, abnormal voltage, threat to system security. Such directions should immediately be acted upon.

6.2.4. The concerned distribution licensee , intra-State user and SLDC shall ensure that their automatic demand management scheme acts to ensure that there is no over drawal when frequency is 49.5 Hz or below. If the automatic demand management scheme has not yet

been commissioned, then action has to be taken as per manual demand management scheme to ensure zero over drawal when frequency is 49.5 Hz or below.

6.2.5. For all outages of generation and transmission system, which may have an effect on the State grid, all users shall cooperate with each other and coordinate their actions as per the procedures finalized separately. In particular, outages requiring restriction of generation which beneficiary can receive (and which may have a commercial implication) shall be planned carefully to achieve the best optimization.

6.2.6. The open access customers/intra-State users shall furnish to the SLDC all requisite information for billing purposes.

6.2.7. All intra-state user(s) shall abide by the concept of frequency-linked load dispatch and pricing of deviations from schedule i.e. unscheduled interchanges (ABT & UI Regulation of the State). All intra state user(s) shall normally be operated according to the standing frequency linked load dispatch guidelines issued by the SLDC to the extent possible, unless otherwise advised by the SLDC except the generators exempted by the Commission by an order or regulations.

6.2.8. Scheduling and dispatch of such long-term or medium-term open access costumers which import and/or export power to the extent of more than 1MW will be subject to scheduling and dispatch by the SLDC in case of intra state transaction except the generators exempted by the Commission by an order or regulations.

The SLDC/STU /Distribution Licensees shall regularly carry out the necessary exercises regarding short-term demand estimation for their respective States/area, to enable them to plan in advance as to how they would meet their consumers' load without overdrawing from the grid.

6.3 Scheduling and Dispatch Procedure

1. The State generating stations ,intra-State sellers in the State shall advise the SLDC, By 9 AM every day, the station-wise ex-power plant MW and MWh capabilities foreseen for the next day, i.e., from 0000 hrs to 2400 hrs of the following day.
2. The above information of the foreseen capabilities of the State generating stations, InSGS and the information received from WRLDC regarding the MW and MWH entitlements from Central generating stations for different hours for the next day of

beneficiary and bulk consumers, shall be compiled by the SLDC every day for the next day, and advised to beneficiaries /bulk consumers by 11AM.

3. By 2 pm every day the State generating stations ,InSGS,beneficiary and bulk consumer shall advise the SLDC for changes if on the above provided schedule.

6.4 By 8 PM each day, the SLDC shall convey:

(a) The ex-power plant "despatch schedule" to each of the the State generating stations and InSGS, in MW for different time block, for the next day. The summation of the ex-power plant drawal schedules advised by beneficiaries/bulk consumer shall constitute the ex-power plant station-wise despatch schedule.

(b) The "net drawal schedule" to each beneficiary/bulk consumer, in MW for different time block, for the next day. The summation of the station-wise ex-power plant drawal schedules from State generating stations ,InSGS and drawal from /injection to State grid consequent to other long term access, medium term and short-term open access transactions, after deducting the transmission losses (estimated), shall constitute the beneficiary/bulk consumer drawal schedule.

6.5 The State generating stations, InSGS, beneficiary and bulk consumer shall inform any modifications/changes to be made in Dispatch/drawal schedule foreseen capabilities, if any, to SLDC by 10 PM or preferably earlier.

6.6 While finalizing the above daily generation schedules for the generating stations, the SLDC shall ensure that the same are operationally reasonable, particularly in terms of ramping-up / ramping – down rates and the ratio between minimum and maximum generation levels.

6.7 The SLDC shall inform the final dispatch/drawal schedule for the next day to State generating stations ,intra-State sellers, beneficiary and intra-state buyer for the next day by 11:00 PM.

6.8 In the event of bottleneck in evacuation of power due to any constraint, outage, failure or limitation in the transmission system, associated switchyard and substations owned by the State Transmission Utility or any other transmission licensee involved in intra-State transmission (as certified by the SLDC) or distribution licensee necessitating reduction in generation, the SLDC shall revise the schedules which shall become effective from the 4th time block, counting the time block in which the bottleneck in evacuation of power has taken place to be the first one. Also, during the first, second and third time blocks of such an event, the scheduled generation of the generators (including CGP) shall be deemed to have been revised to be equal to actual generation, and the scheduled drawals of the beneficiaries/buyers shall be deemed to have been revised accordingly.

In case of any grid disturbance, scheduled generation of all the generating station (including CGP) and scheduled drawal of all the beneficiaries/buyers shall be deemed to have been revised to be equal to their actual generation/drawal for all the time blocks affected by the grid disturbance. Certification of grid disturbance and its duration shall be done by the SLDC.

Generation schedules and drawal schedules issued/revised by the State Load Despatch Centre shall become effective from designated time block irrespective of communication success.

6.9 While finalizing the drawal and dispatch schedules as above, the SLDC shall also check that the resulting power flows do not give rise to any transmission constraint. In case any impermissible constraints are foreseen, the SLDC shall moderate the schedules to the required extent, under intimation to the concerned intra-state users.

6.10 On completion of the operating day, by 24.00 hours, the schedule finally implemented (including PAF in case of State generating station) during the day, taking into account all before the fact changes in dispatch schedule of generating stations and drawal, schedule of the beneficiary/bulk consumer, shall be issued by SLDC. In case of any mistake / omission is detected / noticed in the schedule within 3 days of publication on SLDC website, the SLDC shall check and rectify the same. This schedule shall be the datum for commercial accounting. The average ex-bus capability for each of the generating stations shall also be worked out based on all before-the-fact advice to SLDC.

6.11 The SLDC shall properly document all the above information i.e. station-wise foreseen ex-power plant capabilities advised by the State generating stations,/InSGS and the drawal schedule indented by the beneficiaries/bulk consumers, all schedules issued by the SLDC, and all revisions/updating of the above.

6.12 Bio-mass, small hydel, wind, solar and bagasse base power station installed in State and who are supplying power to any distribution licensee of the state shall continue to supply power as per orders of the Commission, in force.

6.13 For all generators under inter-state ABT scheme, CERC Regulations will be applicable for scheduling and commercial settlement of UI charges.

6.14 SLDC shall monitor and maintain a record of deviation from the generation schedule. The applicable rates shall be paid by the intra-State user(s) to the concerned as per the open access regulations issued by the Commission or as per the terms and condition of the PPA as the case may be.

Revision of declared capability by the SGS(s)/InSGS having two part tariff with capacity charge and energy charge(except hydro stations) and requisition by beneficiary(ies)/bulk consumers for the remaining period of the day shall also be permitted with advance notice. Revised schedules/declared capability in such cases shall become effective from the 6th time block, counting the time block in which the request for revision has been received in the SLDC to be the first one.

6.15 To discourage frivolous revisions, SLDC may, at its sole discretion, refuse to accept schedule/capability changes of less than two (2) percent of previous schedule/capability. The schedule of thermal generating stations indicating fuel shortage while intimating the Declared Capacity to the RLDC shall not be revised except in case of forced outage of generating unit.

6.16 SLDC shall periodically review the actual deviation from the dispatch and net drawal schedules being issued, to check whether any of the intra-state user are indulging in unfair gaming or collusion. In case any such practice is detected, the matter shall be reported to the RPC and CSERC for further investigation/action.

6.17 The SGS / InSGS User shall be required to demonstrate the declared capability of its generating station at the grid interface point, as and when asked by the State Load Despatch Centre. In the event of the intra-state user failing to demonstrate the declared capability, the capacity charges due to the generator shall be reduced as a measure of penalty.

6.18 Day ahead schedule by licensee:

Day ahead transactions shall be permitted ,in case there is availability of surplus capacity in the licensee system, which has been expressly surrendered whole or part thereof, or not in use for more than three days in past.

An application for grant of such open access may be submitted to SLDC within three days prior to the date of scheduling but not later than 1300 hrs of the day immediately preceding the day of scheduling for day ahead transaction.

For example, application for day-ahead transaction on 25th day of July shall be received on 22nd day or 23rd day or up to 1300 hours on 24th day of that month.

Nodal agency shall check for congestion and convey grant of approval or otherwise, in the format as approved in detailed procedure. All other provisions of application for short-term open access shall apply.

6.19 **Reactive Power And Voltage Control**:

1. Regarding VAR drawal/absorption from the State grid, the SLDC has to follow IEGC. The VAR consumption below 97% voltage and VAR injection above 103% of the rated voltage shall be avoided.

2. All the distribution licensees, transmission licensees and STU are expected to provide local VAR compensation such that they do not draw VARs from the EHV grid. VAR compensation has to commence in the following order.
   i. Consumer end
   ii. Distribution transformer end.
   iii. At the 33/11 KV substations or 11kV distribution feeders
   iv. EHV Sub-stations
   v. Generating stations

3. Tap changing on all 400/220 KV ICTs shall be done as per the instructions of SLDC.

4. The generating stations excluding CGP shall generate/absorb reactive power as per instructions of SLDC, within the capability limits of the respective generating units. No payments shall be made or billed to the generating companies for such VAR generation/absorption.

5. VAR compensation shall be applied so as to maintain EHV bus power factor 0.98 and above.

6.20 Non-compliance of Operational Issues

(i) SLDCs shall report to the Commission instances of serious or repeated violation of any of the provisions of the State grid Code and incidences of persistent non-compliance of the directions of the SLDCs issued in order to exercise supervision and control required for ensuring stability of grid operations and for achieving the maximum economy and efficiency in the operation of the power system in the state.

(ii) The Commission may initiate appropriate proceedings upon receipt of report of SLDCs referred to in (i) above

(iii) In case of non-compliance of any provisions of the State Grid Code by, SLDC or any other person the matter may be reported by any person to the CSERC.

(iv) Notwithstanding anything contained in these regulations, the Commission, may also take *suo-motu* action against any person, in case of non-compliance of any of the provisions of the State grid Code

6.21 Non-Payment of Dues

In case of non-payment or any abnormal delay in payment of open access charges, unscheduled interchange charges, etc. by any intra-State user(s)/open access customer the affected parties shall report the matter to the Commission for appropriate direction.

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CHAPTER - 7
PROTECTION CODE

7.1 General Principles

Protection standards are treated as interface issues because of the possible severe inter-user boundary repercussions of faults that occur in the system of any entity. Minimum protection requirements are prescribed in this section because inadequate protection or mal-operation of protection system of any entity may result in far reaching consequences, disturbances and even damages in the systems of other entities.

No item of electrical equipment shall be allowed to remain connected to the system unless it is covered by the appropriate protection aimed at reliability, selectivity, speed and sensitivity. The provision mentioned in CEA (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulation, 2010 shall be adhered to. All the generating companies and the distribution licensees shall cooperate with the transmission licensee to ensure correct and appropriate settings of protection to achieve effective, discriminatory isolation of faulty line / equipment within the fault clearance times as specified in clause 7.4 of this code.

All intra-state users need to co-operate to ensure correct and appropriate settings of protection to achieve effective, discriminatory removal of faulty equipment within the time for target clearance specified in this section.

Protection settings shall not be altered, or protection system bypassed and/or disconnected without consultation and agreement of all affected intra-state users. In the case where protection is bypassed and/or disconnected temporarily by agreement, then the cause must be rectified and the protection restored to normal condition as quickly as possible. If agreement has not been reached, the electrical equipment will be removed from service forthwith.

7.2 STU shall comply the instructions and advices of WRPC regarding:

1. Planning for upgrading and strengthening of protection system based on analysis of grid disturbance and partial/total blackout in State transmission system.
2. Planning of islanding and system split schemes and installation of under frequency relays and df/dt relays.
3. Installation of under-frequency relay for load shedding, relays provided for islanding scheme, disturbance recorder and fault locator installed at various sub-stations shall be tested and calibrated. The protection practices and Protocol Manual shall have provision for the same.

7.3 Protection Co-ordination

Intra-state users shall take prompt action to correct any protection malfunction as directed by SLDC. The settings of protective relays starting from the generating unit upto the remote end of 132 kV/ 33kV and 11 kV line shall be such that only the faulty section is isolated under all circumstances. The transmission licensee shall notify the initial settings and any subsequent changes to the intra-state users from time to time. Routine checks on the performance of the protective relays shall be conducted and malfunction, if any, shall be noted and corrected as soon as possible. The transmission licensee shall conduct the required studies for deciding the relay settings, with the data collected from the intra-state users. Representatives of all the intra-state user(s) shall meet periodically to discuss such malfunctions, changes in the system configuration, if any, and possible revised settings of relays.

The transmission licensee shall be responsible for arranging periodical meetings with the generating companies and the distribution licensees to discuss coordination of protection. The transmission licensee shall investigate any malfunction of protection or other unsatisfactory protection issues. The concerned licensees shall take prompt action to correct any protection malfunction or issue as discussed and agreed to in these periodical meetings.

7.4 Fault Clearance Times & Short-Time Ratings

From a stability consideration, the minimum short circuit current rating and time and the maximum fault clearance times for faults on any intra-state user's system directly connected to the State transmission system, or any faults on the State transmission system itself, are as follows with reference to CEA (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulation, 2010 and CEA Grid Standards Regulation, 2010 :

Nominal Voltage	Minimum Short Circuit current rating and duration of Switchgear		Maximum rated break time for CB	Target Fault clearance Time by primary protection
KV	kA (rms)	Second(s)	m.sec.	m.sec.
765 kV	40 or 50	1	40	100
400kV	40 or 50	1	40	100
220kV	40	1	60	160
132kV	31.5	1 or 3	100	160

Slower fault clearance times for faults on a intra-state user's system may be agreed to but only if, in STU's opinion, system conditions allow this. STU shall specify the required opening time and rupturing capacity of the circuit breakers at various locations for STU and Discoms/ open access customers directly connected to transmission system. The rated rupturing

capacity of the circuit breakers in any Sub-station shall not be less than 120% of the maximum fault levels at the sub-stations. (The 20% margin is intended to take care of increase in short circuit levels as the system grows). At generating stations, line faults should be cleared at the generation station end, within the critical clearing time, for the generators to remain in synchronism.

7.5 Generator Protection Requirements

The guidelines mentioned in the "Manual on protection of Generators, Generator Transformers, and 220 kV and 400 kV networks" vide publication no 274 of CBIP shall be kept in view and CEA (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulation, 2010 as amended from time to time should be followed.

All generating units and all associated electrical equipment of the generating units connected to the State transmission system shall be protected by adequate protection so that the State Transmission System does not suffer due to any disturbances originating from the generation unit. The generator protection schemes shall cover at least differential protection, back up protection, stator earth fault protection, field ground/field failure protection (not applicable to brush-less excitation system), negative sequence protection, under frequency, over flux protection, back-up impedance protection and pole slipping protection (applicable to units above 200MW), loss of field protection, reverse power protection etc. The list of Electrical Protection Function of generating plant should be followed which is specified in CEA (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulation, 2010.

7.6 Transmission Line Protection Requirements

7.6.1 General

Every EHV line taking off from a Power Station or a sub-station shall have protection and back up protection as mentioned below. STU shall notify intra-state users of any changes in its policy on protection from time to time.

Relay panels for the protection of lines of STU taking off from a power generating station. shall be owned and maintained by the generator. Any transmission line related relay settings or any change in relay settings will be carried out by the generator in close co-ordination and consultation with STU and with the later approval. Carrier cabinets / equipment, line matching units including wave traps and communication cable shall be owned and maintained by STU charges for which shall be collected or approved by the Commission. All generators shall provide space, connection facility, and access to STU for such purpose as applicable.

All Intra-state users shall also facilitate identification, installation and commissioning of System Protection Schemes (SPS) (including inter-tripping and run-back) in the power system to operate the transmission system closer to their limits and to protect against situations such as voltage collapse and cascade tripping, tripping of important corridors/flow-gates etc. If any SPS is to be taken out of service, permission of SLDC shall be obtained indicating reason and duration of anticipated outage from service.

7.6.2 400kV transmission lines

All 400kV transmission lines shall have two fast acting protection schemes, the voltage of the two relays shall be fed from two different cores of the line CVT and the currents of the two relays shall be fed from two different cores of the line CTs. Main 1 protection scheme shall be numerical, three zone, non-switched fast acting distance protection scheme with permissible inter-trip at remote end (in case of zone-2 fault)

Main 2 protection scheme shall be either similar type of numerical, three zone, non-switched fast acting distance protection scheme with permissible inter-trip at remote end (in case of zone-2 fault) OR a unit protection scheme employing transient wave detection, directional comparison or phase comparison carrier relaying scheme.

One pole tripping and single shot auto-reclosing with adjustable dead-time shall be provided.

Over voltage relay for steady state and transient over voltage rise will have to be installed.

400kV and 220kV system will invariably be provided with breaker back up protections.

400kV line /220 kV lines protection will have inter trip arrangement through carrier so that tripping at one end of line is transmitted to other end also.

7.6.3 400kV Bus-bars

All 400kV sub-station shall have bus bus-bar differential protection scheme along with "Local Breaker Backup (LBB)" and auto-reclosures for transmission lines.

7.6.4 220kV transmission lines

All 220kV transmission lines shall have single, numerical, three zone, non-switched fast acting distance protection scheme, preferably with permissible inter-trip feature at remote end (in case of zone-2 fault), single pole tripping and single-shot single pole autoreclosing with adjustable dead-time shall be provided.

For back-up protection, three directional IDMT over current relays and one directional earth fault relay shall be provided.

For short transmission lines, appropriate alternative protection schemes may be adopted.

7.6.5 **220kV Bus-bars**

Identified important 220kV sub-station (e.g. having generation infeed, PGCIL interfacing substation etc.) shall have bus bus-bar differential protection scheme along with LBB and autoreclosures for transmission lines.

7.6.6 **132kV Lines**

A single three zone, switched/non-switched static distance protection scheme shall be provided as main protection. The backup protection shall be at least two directional IDMTL over current relays and one directional earth fault relay.
For short transmission line, appropriate alternative protection schemes may be adopted.

7.7 Transformer Protection Requirements

(i) The protections of Auto Transformers, Power Transformers and Distribution Transformers shall be in accordance with CEA (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulation, 2010 and its amendments:

(ii) All windings of Auto Transformers and power transformer of EHT class shall be protected by differential relays having percent bias and harmonic restraint features.

(iii) Over-fluxing relays shall be provided for EHT transformers.

(iv) All 400kV / 220kV class transformers shall have Restricted Earth Fault (REF) protection for winding. In case of 132kV transformer, it is optional.

(v) In addition, there shall be back up Inverse definite minimum time (IDMT) over current and earth fault protection.

(vi) For parallel operation, such back up protection shall have directional feature. For protection against heavy short circuits, the over current relays should incorporate a high set instantaneous element, wherever overall co-ordination permits the same. However, it should not trip due to inrush of the magnetising current and should not be set to such a high value, which is not beneficial to transformer.

(vii) In addition to electrical protection, gas operated relays, winding temperature protection and oil temperature protection shall be provided.

(viii) It is recommended that the following minimum protections should be provided for transformers:

(a) All 400kV class power transformers shall be provided with differential, REF, open delta (Neutral Displacement Relay) and over-fluxing relays. In addition, there shall be back up IDMT over current and earth fault protection. For parallel operation, such back up protection shall have inter-tripping of both HT and LT breakers. For protection against heavy short circuits, the over current relays should incorporate a high set instantaneous element. In addition to electrical protection, transformer own protection viz. buchholz, over load tap changer (OLTC) oil surge, gas operated relays, winding temperature protection, oil temperature protection, Pressure relief valve (PRV) device shall be provided for alarm and trip functions. It is recommended to have Double PRV protection scheme for transformer tank.

(b) All 220kV class power transformers shall have same protections as mentioned in Sections as mentioned in 8. (i) except REF protection.

(ix) Delta tertiary winding of ICT if used for loading purpose shall be adequately protected by a Lighting Arrestor , surge capacitor and neutral displacement relay (NDR) protection connecting as open delta winding of Potential Transformer (PT).

7.8. **Local breaker backup protection (LBB)**:- In the event of any circuit breaker failing to trip on receipt of trip command from protective relay, all circuit breakers connected to the bus section to which the faulty circuit breaker is connected are required to be tripped with minimum possible delay through LBB protection. This protection also provides coverage for faults between the circuit breaker and the current Transformer, which are not covered by other protections. All 220kV and 400kV circuits shall have Local Breaker Backup Protection and also in important 132 kV circuit.

7.9. **Disturbance Recorders Event Loggers and Time Synchronization Equipment :-** Each 765kV, 400 kV line shall be provided with facility for distrurbance recording, distance to fault locator and time synchronising equipment (TSE). Event logger either stand alone or as part of sub-station or switchyard automation system shall be provided for each 220kV and higher voltage class sub-station or switchyard. TSE complete with antenna, all cables, processing equipment etc., shall be provided to receive synchronizing pulse through global positioning system (GPS) compatible for synchronization of event logger, disturbance recorder and SCADA/automation system of the sub-station or switchyard.

7.10. **Transformer Protection in distribution systems**: For smaller transformers of HV class on distribution system, differential protection shall be provided for 10 MVA capacity and above along with backup time lag over current and earth fault protection with directional feature for parallel operation. Transformers of 1.6 MVA capacity and above but less than 10 MVA shall be protected by time lag over current, earth fault and instantaneous restricted earth fault relays. In addition, all Transformers of 1.6 MVA and above shall be provided with Buchholtz relays, winding and oil temperature protection.

7.11. **Distribution Lines Protection** : All the 33KV and 11 KV lines at Connection points/ interface points shall be provided with a minimum of over current and earth fault relays as follows:-

(i) Plain Radial Feeders: Non-directional over current and earth fault relays with suitable settings to obtain discrimination between adjacent relay settings.

(ii) Parallel / Ring Feeders: Directional time lag over current and earth fault relay.

7.12. **Sub-Station earthing :-** The earthing system shall be designed for a life expectancy of at least forty (40) years and for maximum system fault current or 40 kA for 1.0 sec, whichever is higher. The minimum rate of corrosion of steel used for earthing conductor shall be considered as 0.12 mm per year while determining the conductor size. Grounding and lighting protection for the entire Station shall be provided in accordance with relevant IS (Indian Standard)/ IEEE (Institute of Electrical and Electronics Engineers) Standards.

7.13. Schedule of protection details for protection of Transmission lines, Transformers, Reactors and Bus Bars is given here under as specified in CEA (Technical Standards for Construction of Electrical Plants and Electric Line) Regulation, 2010

Protection Details of Transmission Lines, Transformers, Reactors and Bus Bars

1. Transmission Line Protection

Sl. No.	Protection	765 kV	400 kV	220 kV	132 kV or 66 kV
(a)	Main I- Distance protection	Y	Y	Y	Y
(b)	Main I- Distance protection or directional comparison protection or phase segregated line differential protection	Y	Y	Y/N	Y
(c)	Directional instantaneous definite minimum time (IDMT) type earth fault relay	Y	Y	'Y' if both main-I & main-II are distance protections otherwise 'N'	N

(d)	Directional IDMT over current and earth fault back up protection	N	N	'Y' if main-II is not provided otherwise 'N'	Y
(e)	Two stage over voltage protection	Y	Y	N	N
(f)	Auto reclosing	Y (Single phase and three phase)	Y (Single phase and three phase)	Y (Single phase and three phase)	Y (Three phase)

Note :

(1) Y - Required ; N - Not required; Y/N - Optional

(2) Transmission lines with distance protection shall, in general have carrier aided inter-tripping or blocking feature. Separate cores of current transformer and voltage transformer shall be used for main-I and main-II.

2. Transformer Protection

Sl. No.	Protection	765 kV	400 kV	220 kV or 132 kV	66 kV
(a)	Differential protection	Y	Y	Y	Y
(b)	Over fluxing protection	Y	Y	Y	N
(c)	Restricted earth fault (REF) protection	Y	Y	Y	Y
(d)	Backup directional over current and earth fault protection (HV and LV side or impedance protection)	Y	Y	Y	Y
(e)	Buchholz WTI and OTI (for 1 MVA and above), MOG with low oil level alarm, OSR for OLTC, PRD, SA on both primary and secondary side of transformers located outdoors and connected to over head lines	Y	Y	Y	Y
(f)	Tertiary winding protection	Y	Y	Y (above 100 MVA rating)	Y
(g)	Over load alarm	Y	Y	Y	N

Note :

(1) Y - Required ; N - Not required.

(2) WTI winding temperature indicator; OTI- oil temperature indicator; C .TC or load tap changer; PRD pressure relieve device; OSR- oil surge relay; MOG- nagnetic oil gauge; SA- surge arrester.

3. Reactor Protection

Sl. No.	Protection	765 kV	400 kV
(a)	Differential protection	Y	Y
(b)	REF protection	Y	Y
(c)	Reactor backup protection (impedance type or definite time over current (O/C) and earth fault (E/F) protection)	Y	Y
(d)	Buchholz, WTI, OTI, MOG with low oil level alarm, SA (if required)	Y	Y

Note :

(1) Y - Required.

(2) WTI winding temperature indicator; OTI- oil temperature indicator; MOG- magnetic oil gauge; SA- surge arrester.

7.14. **Bus Bar Protection and Local Breaker Backup Protection** - Bus bar protection and local breaker backup protection shall be provided in 220 kV and higher voltage interconnecting sub-stations as well as in all generating station switchyards. The bus bar protection scheme shall have provision for future expansion.

7.15. Sub-station Fire Protection

Adequate precautions shall be taken and protection shall be provided against fire hazards to all apparatus of the intra-state users conforming to relevant Indian Standard Specification and /or provisions of CEA (Technical Standards for Construction of Electrical Plants and Electric Line) Regulation, 2010 and CEA (Measures Relating to Safety and Electric Supply) Regulations, 2010.

7.16. Calibration & Testing

The protection scheme shall be tested at each 400kV, 220kV, 132kV sub-station by STU once in a year or immediately after any major fault, which ever is earlier. Setting, co-ordination, testing and calibration of all protection schemes pertaining to generating units/stations shall be responsibility of individual concern.

7.17. Data Requirements

Intra-state users shall provide STU with data for protection purpose as specified in the Data Registration section.

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CHAPTER - 8

METERING CODE

8.1 General Principles

8.1.1 The scope of this part of the grid code covers the practices that shall be employed and the facilities that shall be provided for the measurement and recording of various parameters of electricity like active/reactive/apparent power/energy, power factor, voltage, frequency etc.

8.1.2 This Code sets out or refers to the requirements of metering at generating stations, sub-stations and interfaces for main meter, check meter, standby meter, consumer meter (tariff meter), and for energy accounting and audit meter as specified in the CEA (Installation and Operation of Meter) Regulations, 2006 as amended from time to time.

8.1.3 This Code also specifies the requirement for calibration, testing and commissioning of metering equipments viz. energy meters with associated accessories, current transformers and voltage transformers. The code broadly indicates the technical features of various elements of the metering, data communication, testing and calibration system, the procedure for assessment of consumption in case of defective and stuck-up meters and also lays down guidelines for resolution of disputes between different agencies.

8.1.4 The generating plants supplying power to the open access consumer, will be required to provide the metering as per ABT scheme and ABT compliant meters will be installed at both ends i.e. at injection point and drawal point.

8.1.5 In case Intra-state users / Open access customers/consumers provide the meters it shall have to provide software for billing to licensee and for operation to SLDC with communication facility for transfer of real time data through v-set or through lease line.

8.2 Reference Standards

8.2.1 The following Indian Standards (as amended to date) shall be applicable as relevant to meters and associated equipment:-

S.No.	Standard Number	Standard Title
(i)	IS 13779	AC Static Watt-hour Meters for Class 1 and 2
	IS 14697	AC Static Transformer Operated Watt-hour and VAr-hour Meters, Class 0.2S and 0.5S
	IS 2705	Indian Standard for Current Transformers
	IS 3156	Indian Standard for Voltage Transformers

	IS 9348	Indian Standard for Coupling Capacitors and Capacitor Divider
	IS 5547	Indian Standard for Capacitor Voltage Transformer
(ii)	CBIP Technical Report - 88	Specification for AC Static Electrical Energy Meters
(iii)	CBIP Technical Report - 111	Specification for Common Meter Reading Instrument
(iv)	IS 9000	Basic Environmental Testing Procedures for Electronic & Electrical items
(v)	IS 12063	Indian Standard for classification of degrees of protection

8.2.2 The following International Standards (as amended to date) can be applicable as relevant to meters and associated equipment not complying to Indian Standards or not manufactured in India:

S. No.	Standard Number	Standard Title
i.	IEC 687	Specification for AC Static Watt-hour Meters for Active Energy (Classes 0.2S and 0.5S)
ii.	IEC 1036	Alternating Current Static Watt-hour Meters for Active Energy (Classes 1 and 2)
iii	IEC 1268	Alternating Current Static Watt-hour Meters for Reactive Energy (Classes 2 and 3)

8.3 Facility to be provided on Metering Locations

The intra-state user(s) where ever applicable shall make available the required space to facilitate installation of meters and associated equipment.

8.4 Application of metering system (ownership and location) - Ownership and location of meter shall be as below :-

8.4.1 (a) All interface meters installed at the points of interconnection with Inter-State Transmission System (ISTS) for the purpose of electricity accounting and billing shall be owned by CTU.

(b) All interface meters installed at the points of interconnection with Intra-State Transmission System excluding the system covered under sub-clause (a) above for the purpose of electricity accounting and billing shall be owned by STU. Cost of meter to be borne by the intra-state users.

(c) All interface meters installed at the points of inter connection between the two licensees excluding those covered under sub-clauses (a) and (b) above for the purpose of electricity accounting and billing shall be owned by respective licensee of each end. Cost of meter to be born by individual licensee..

(d) All interface meters installed at the points of inter connection for the purpose of electricity accounting and billing not covered under sub-clauses (a), (b) and (c) such as in premises of open access customers shall be owned by supplier of electricity i.e. licensee) cost of which will be born by open access customers.

(e) For the EHV consumers those are directly connected to transmission system the metering at consumer premises, energy accounting and billing shall be as per provision in Chhattisgarh State Electricity supply code.

8.4.2 **Generating plants:**

All generating plants including non conventional sources based Power Generating plants, connected to intrastate transmission system directly or through the system other than system of STU, may have energy meter installed at each generator terminal, HV side of generator step-up transformer (Standby Meter), HV side of unit auxiliary transformer (UAT), HV side of Station Transformers (ST).

8.4.3 **Metering between State transmission utility-distribution licensee:**

For measurement of power delivered by State transmission utility to distribution licensee (excluding station transformer consumption), metering shall be provided on the LV side of EHV Power Transformer i.e. 33kV side of 132/33kV and 11kV side of 132/11kV transformers installed in EHV sub-stations.

In case of multiple distribution licensees energy accounting meters shall be provided on all outgoing 33kV and 11kV feeders and reconciliation of energy shall be made by audit meter installed on LV side of power transformer at EHV sub-station.

8.4.4 **Sub-station Auxiliary Consumption Metering:**

The State transmission utility sub-stations auxiliary consumption shall be recorded on LV side of station auxiliary transformers. If such transformer(s) is feeding other local load (colony quarters, street lights etc.) apart from sub-station auxiliary load, separate metering shall be provided on individual feeders.

8.4.5 **Operational Metering:**

Operational metering shall be installed wherever reasonably required by State transmission utility /generating companies for applications other than tariff metering. The parameters and other requirements shall be finalized by State transmission utility based on the operational requirements.

8.5 **Operation and Maintenance of the Metering System**

The operation and maintenance of the meter and metering system shall be the exclusive responsibility of owner which includes proper installation, regular maintenance of the metering system, checking of errors of the CTs, VTs and meters, proper laying of cables and protection thereof, cleaning of connections/joints, checking of voltage drop in the CT/ VT leads, condition of meter box and enclosure, condition of seals, regular/daily reading meters and regular data retrieved through common meter reading instrument (CMRI) and data processing system (DPS), attending any breakdown/fault on the metering system etc.

8.6 Minimum technical requirements for energy meter

8.6.1 Measuring Elements: The meter shall be 3 phase 4 wire, full four quadrant type static Tri-vector Meter (TVM), which can be used for 3 phase 3 wire system or 2 phase 2 wire system (traction application) without affecting the metering accuracy and other essential parameters.

8.6.2 In case of import and export power requirement of different degree by the captive power generators/ consumers through the same connectivity /line, proper metering should be assured by licensee in such case keeping adequacy and adequate accuracy class of metering system.

8.6.3 The ABT meter shall have facility to correct the ratio error and phase angle error of external CTs and VTs connected to it.

8.6.4 Meter should measure fundamental RMS value of electricity and harmonics.

8.6.5 Operating System Parameters (for balanced and unbalanced load):

(a) Operating Voltage Range: The meter shall work satisfactorily on 110 Volts AC (Line-Line) with variation range of -20% to + 15%.

(b) Operating Frequency Range: The meter shall work satisfactorily on 50 Hertz with variation range of -5% to +5%.

(c) Operating Power Factor Range: The meter shall work satisfactorily over a power factor range of zero lag to unity to zero lead.

8.6.6 Rated Nominal Current and Rated Maximum Current: Meter shall operate on I Ampere or 5 Ampere from CT secondary circuit. Rated maximum secondary current shall not exceed 120% of nominal current.

8.6.7 Rated Short time Current: Meter shall be capable of withstanding 20 times the rated nominal current for 0.5 second.

8.6.8 Minimum Starting Current: The meter shall start operating and recording energy with minimum starting current equal to 0.1 % of nominal current at unity power factor.

8.6.9 Burden and Power Consumption: The burden imposed by the metering system shall not exceed 1 W, 8 VA for voltage circuit and 1 VA for current circuit so that there is no significant voltage drop in the VT and CT leads.

8.6.10 **Accuracy Class**

Meter shall meet the following requirement of accuracy class . (Better than the mentioned accuracy class shall be acceptable):

Interface meters	0.2S	
Consumer Meter	11 kV and 33 kV	0.5S or better
	Above 33 kV	0.2S or better
Energy Accounting and audit meter	(1) In generating station, the accuracy class of meters at a point after the generator stator terminals and before the tap of to the unit auxiliary transformer(s) shall not be inferior to that of 0.2S accuracy class. However, the accuracy class of other meters shall not be inferior to that of 1.0S accuracy class. (2) The accuracy class of meters in transmission system shall not be inferior to that of 0.2S accuracy class. (3) The accuracy class of meters in distribution system shall not be inferior to that of 0.5S accuracy.	

[Reference CEA (Installation and Operation of Meter) Regulations, 2006 as amended from time to time.]

8.6.11 **Earthing System**: The metering system shall be suitable for solidly earthed power system.

8.6.12 **Meter Box:** The meter box shall confirm to the degree of protection not less than IP-51 as stipulated in IS 12063, and shall be capable of satisfactory operation in an indoor, non-air conditioned installation.

8.6.13 Installation and mounting:

The meter shall be suitable for install indoor or outdoor application. In case CTs and VTs form part of the meters, the meter shall be installed as near the instrument transformers as possible to reduce the potential drop in the secondary leads.

The meter can be mounted in dust proof, lockable and tamper proof panel or rack or metal box, as per requirement and site condition, conforming to minimum IP-31 standards.

The metering system shall have facility of CT shorting when the meter module is withdrawn or dismantled.

8.6.14 **Data Display Capabilities** - Instantaneous Values:

The meter shall be capable to record and display (on demand) at least the following instantaneous parameters/information:

(a) Three rms line voltages
(b) Three rms line currents
(c) System frequency (Hz)
(d) Power factor with sign of lag/lead.
(e) Watt - Import
(f) Watt - Export
(g) VAr - Lead
(h) VAr - Lag
(i) VA - Import
(j) VA - Export
(k) Maximum Demand (Import) during the month in Watt and VA with date and time
(l) Maximum Demand (Export) during the month in Watt and VA with date and time
(m) Meter Serial Number

8.6.15 **Data Storage Capabilities** - Cumulative Values:

The meter shall be capable to record, store and display (on demand) at least following cumulative parameters. At least five (5) registers shall be provided for each parameter, out of which one (1) register shall record energy for 24 hours in a day whereas other four (4) registers shall record Time of Day (TOD) energy during morning peak, morning offpeak, evening peak and evening off-peak durations:

(a) Watt hour - Import
(b) Watt hour - Export
(c) VAr hour - Lead while Watt hour - Import

(d) VAr hour - Lag while Watt hour - Import

(e) VAr hour - Lead while Watt hour - Export

(f) VAr hour - Lag while Watt hour - Export

(g) VA hour - Import

(h) VA hour - Export

(i) VAr hour during low voltage (V<97%)*

(j) VAr hour during high voltage (V>103%)*

These parameters are for Availability Based Tariff (ABT) purpose only hence TOD registers are not required

8.6.16 **Data Logging Capabilities 1** - Integrated Values:

The meter shall have sufficient memory to store any combination of at least ten (10) parameters listed in Clause 8.6.14 and Clause 8.6.15 over minimum forty (40) days at a logging interval of fifteen (15) minutes. The State transmission utility shall be able to select these parameters locally through optical port using CMRI and/or remotely through communication port. At least, following essential parameters shall be logged at an interval of 15 minutes:

(a) Watt - Import

(b) Watt - Export

(c) VAr - Lead while Watt - Import

(d) VAr - Lag while Watt - Import

(e) VAr - Lead while Watt - Export

(f) VAr - Lag while Watt - Export

(g) VAr hour during low voltage (V<97%)

(h) VAr hour during high voltage (V>103%)

(i) Average frequency (Hz)

(j) Average three phase voltage

In case of operational metering, the number of parameters and their logging intervals shall be decided by the Licensee as per their operational requirements.

8.6.17 Other Parameters:

Each meter shall also store the values of active energy (Import), active energy (Export), reactive energy (lag) and reactive energy (lead) separately during active energy (import) & active energy (export) conditions recorded at 24.00 hours on last day of the month for a period of at least twelve (12) months in any case. Intra-state user shall be able to program time and day at which value of energy to be stored in the memory.

8.6.18 Events and Abnormalities Logging Capabilities:

The meter shall be able to log date and time stamped events captured with a resolution of at least one (1) second. Sufficient memory shall be provided to store at least last 100 events in the meter on First-In-First-Out (FIFO) basis with compartment wise as following, but not limited to:

(a) Missing potential (VT supply missing)

(b) CT/VT Polarity reversal

(c) Current unbalances (magnitude as well as phase unbalance) in any one of the phases or more than one phase

(d) Voltage unbalances (magnitude as well as phase unbalance) in any one of the phases or more than one phase

(e) Supply interruptions along with the duration of each interruption

(f) Tamper information/anomaly occurrence/anomaly restoration.

(g) Meter internal set-up/program change information

8.6.19 Real Time Clock (RTC) and Calendar:

The meter shall have in-built Quartz crystal based accurate Real Time Clock. The meter shall display real time in 24 hours format (hh: mm: ss).

Meter shall also display the date as per Indian calendar in dd-mm-yyyy format. Thirty (30) years calendar with automatic leap year adjustment shall be provided in the meter.

The accuracy of the clock and calendar shall not be more than 1 (one) minute per year or better than 1 (one) minute per year.

8.6.20 Time synchronization:

All meters shall have facility for time synchronisation locally and/or remotely through a Global Positioning System (GPS) or through the central computer (at CDCC) using the same port used for remote data communication.

8.6.21 Data retention:

The logged data shall be stored in a non-volatile memory of meter with a minimum retention period of ten (10) years without any battery back-up.

8.6.22 **Data concentration and network integration:**

The local network of all meters installed in a sub-station shall be formed using modem/multiplexer/data concentrator/LAN hub switch. This local network shall be integrated with communication network using appropriate standard protocol.

Communication network may be based on Radio frequency, Microwave, Public Switched Telephone Network (PSTN), Power Line Carrier Communication (PLCC), Vary Small Aperture Terminal (VSAT) network, Optical Fibre Cable (OFC), GSM, Low Power Radio Frequency or any other means of telemetry.

8.6.23 Pulse Output:

High intensity light emitting diodes (LED) shall be provided on front of the meter for test calibration and accuracy check of Wh and VArh measurements.

8.6.24 **Display:**

Meter shall have a minimum of 7 digits Alpha-numeric liquid crystal display (LCD) or light emitting diode (LED) type display with bright back-light and automatic back-light time out feature. A touch key pad or push buttons shall be provided on the meter front for switching ON the display and for changing from one indication to next. Two separate push buttons shall be provided one for scrolling and other for MD resetting.

8.6.25 **Data Security:**

(a) Data encryption (coding) capability

(b) Mechanical seals and locks i.e. sealing provision for terminal block, meter cover, MD reset predefined date and time or CMRI and all communication ports.

(c) Message authentication algorithm capability/Multi-level password protection

(d) Independent security across communication channels

8.6.26 **Self-Diagnostics feature:**

The meter shall have self diagnostics feature to scan the healthiness of internal components and circuitry. On detection of any exception or fault, meter shall display the message immediately.

8.6.27 **Communication Ports:**

The meter shall have at least following communication ports:

(a) One optically isolated infra-red communication port (optical port) for local communication as per IEC 1107

(b) One galvanically isolated Ethernet (LAN) port or RS485 serial port or RS232 serial port for remote communication

8.6.28 **Communication Protocol**:

For communication by meter with external devices, meter supplier shall implement industry standard open protocol(s) like MODBUS RTU, MODBUS, TCP/IP, IEC 870-5-102, IEEE 1377, DNP 3.0, Device Language Message Specification (DLMS) or any other industry standard protocol.

In case of proprietary protocol, the meter supplier shall furnish the protocol software and details of protocol followed by him. Any variation in the standard protocol for optimizing communication resources shall be detailed.

8.6.29 Reprogramming of the meter:

Utility shall be able to select the display parameters, logging parameters, timings of TOD registers, billing dates, logging interval or any other parameter locally using CMRI through optical and/or remotely using meter reprogramming software installed at CDCC through communication port(s).

8.6.30 **Data Downloading**:

Utility shall be able to download the logged data locally using CMRI through optical port and/or remotely using meter interrogation software installed at CDCC through communication port(s). Any interrogation/read operation shall not delete or alter any stored meter data.

8.6.31 External auxiliary supply:

The metering system shall derive operating system from AC or DC auxiliary supply. For auxiliary supply the internal DC battery which is an integral part of the meter or capacitor devices, incorporated in the meter, should be used.

8.7 Minimum technical requirement for instrument transformer :

8.7.1 Single-phase type current transformers shall be used for 3 phase 4 wire and 3 phase 3 wire or 2 phase 2 wire (traction application) measurement system. The secondary current rating of the current transformer (CT) shall be 1 ampere or 5 ampere depending upon the total circuit burden. 5A secondary can be used for low burden circuits.

8.7.2 Either dedicated set of CT / VT or dedicated core of current transformers shall be provided for metering and wherever feasible, CTs (or their cores) feeding to main meters and check meters shall be separate. The errors of the CT / VT shall be checked in the laboratory or at site. The CT / VT shall be tested using the testing equipment calibrated by any NABL lab or any NABL accredited laboratory." The main meter and check meter shall be connected to same core of CTs and VTs.

8.7.3 The total burden connected to each current transformer shall not exceed the rated burden of CT/VT. Total circuit burden shall be kept close to rated burden of CT for minimum error and percentage voltage drop in VT leads shall be within the permissible limits.

8.7.4 Either Electromagnetic Voltage Transformers (EVT) or Capacitive Voltage transformer (CVT) may be used for metering purpose. Generally, voltage transformers (VT) is used to cover either EVT or CVT. The secondary voltage per phase shall be 110/v3 volts. For protection of VT suitable devices such as MCB's etc may be used.

8.7.5 The minimum acceptable detailed specification for instrumentation transformer are as follows.

A) Minimum acceptable specifications of dedicated single-phase EHV & HV current transformers (CT) for metering

S.No.	Particulars	11KV	33KV	132KV	220KV
1	Nominal System Voltage (Kv rms)	11	33	132	220
2	Highest System Voltage (kV rms)	12	36	145	245
3	Reference Standard	IS 2705 with latest amendments			
4	Standard CT Ratio	2000 or 1000/1-1	800 or 400/1-1	800 or 400/1-1-1	1200 or 600/1-1-1-1
		1600 or 800/1-1	600 or 300/1-1	400 or 200/1-1-1	800 or 400/1-1-1-1
		1200 or 600/1-1	400 or 200/1-1	200 or 100/1-1-1	
		800 or 400/1-1	300 or 150/1-1	100 or 50/1-1-1	
		600 or 300/1-1	100 or 50/1-1		

S.No.	Particulars	11KV	33KV	132KV	220KV
		400 or 200/1-1			
		300 or 150/1-1			
		150 or 75/1-1			
5.	No. of Metering cores	Two			
6.	Rated Continuous Thermal Current	120% of Rated Primary Current			
7.	Rated Short time thermal primary current	13.1 KA for 1 sec	26.2 KA for 2 sec	31.5/40 KA for 1 sec	40 KA for 1 sec
8.:	CT characteristics				
(a)	Rated Primary Current (Amps)	2000 or 1000	800 or 400	400	800
		1600 or 800	600 or 300	200	
		1200 or 600	400 or 200	100	
		800 or 400	300 or 150	50	
		600 or 300	100 or 50		
		400 or 200			
		300 or 150			
		150 or 75			
(b)	Rated Secondary Current (Amps)	1 or 5	1 or 5	1 or 5	1 or 5
(c)	Accuracy Class	0.5S	0.5S	0.2S	0.2S
(d)	Maximum Instrument Security Factor (ISF)	5	5	5	5
(e)	Rated Secondary Burden (VA)	30	30	15	15
9.	Reference Standard for insulating oil	IS 335 with latest amendments			

B) Minimum acceptable specifications of dedicated three-phase HV CT-PT set for metering

S.No.	Particulars	33kV
Specification of CT (for CT-PT Set)		
1	Nominal System Voltage (kV rms)	33
2	Highest System Voltage (kV rms)	36
3	Reference Standard	IS 3156 with latest amendments
4	Standard CT Ratio (Amps/Amps)	200 or 100/1-1 100 or 50/1-1
5	Rated continuous thermal current	120% of rated primary current

6	Rated short time thermal primary current for 1 second (in kA)	25
7	CT Characteristic:	
a	Rated Primary Current (Amps)	200 or 100 100 or 50
b	Rated Secondary Current (Amps)	1 or 5
c	Accuracy Class	0.5S
d	Maximum Instrument Security Factor (ISF)	<10
e	Rated Secondary Burden (VA)	30
8.	Reference Standard for insulating oil	IS 335 with latest amendments
Specification of PT (for CT-PT Set)		
1	Nominal System Voltage (kV rms)	33
2	Highest System Voltage (kV rms)	36
3	Reference Standard	IS 3156 with latest amendments
a	No. of Secondary Windings for potential measurement devices	Two
b	Standard Voltage Ratio	33kV/√3 / 110V/√3
c	Rated Secondary Burden (VA) per winding	50
d	Accuracy Class (At 10% to 100% of rated VA burden)	0.5S
e	Rated Voltage Factor and Duration	1.2 continuous and 1.5 for 30 seconds

C) Minimum acceptable specifications of dedicated single-phase EHV capacitor voltage transformers (CVT) for metering

Sr. No.	Particulars	132kV	220kV
1	Nominal System Voltage (kV rms)	132	220
2	Highest System Voltage (kV rms)	145	245
3	Reference Standard	IS 3156 with latest amendments	
4	Rated Capacitance (pF)	4400 pF with tolerance +10% and -5%	
5	For low voltage terminal over entire carrier frequency		
	(a) Stray Capacitance	Shall not exceed 200 pF	
	(b) Stray Conductance	Shall not exceed 20 micro siemens	
6	(a) High frequency capacitance for entire carrier frequency range	Within 80% to 150% of rated capacitance	
	(b) Equivalent Series Resistance over the entire frequency range	Less than 40 ohms	
7	No. of Secondary Windings for potential measurement devices	Three	Three

8	Standard Voltage Ratio		
	(a) Winding-I, II, III	132kV/√3 / 110V/√3	220kV/√3 / 110V/√3
9	Rated Secondary Burden (VA)		
	(a) Winding-I	-----	-----
	(b) Winding-II & III	50	50
10	Accuracy Class		
	(a) Winding-I	3P	
	(b) Winding-II	0.2	
	(c) Winding-III	0.2	
11	Rated Voltage Factor and Duration		
	(a) Winding-I	1.2 continuous and 1.5 for 30 seconds	
	(b) Winding-II	1.2 continuous and 1.5 for 30 seconds	
12	Reference Standard for insulating oil	IS 335 with latest amendments	

NOTE: Electromagnetic VTs may be used up to 220KV class.

D) Minimum acceptable specifications of dedicated single-phase EHV potential transformers (PT) for metering

S. No.	Particulars	132kV	220kV
1	Nominal System Voltage (kV rms)	132	220
2	Highest System Voltage (kV rms)	145	245
3	Reference Standard	IS 3156 with latest amendments	
4	No. of Secondary Windings for potential measurement devices	**Three**	**Three**
5	Standard Voltage Ratio		
	(a) Winding-I,II, III	132kV/√3 / 110V/√3	220kV/√3 / 110V/√3
6	Rated Secondary Burden (VA)		
	(a)Winding-I	----	----
	(b) Winding-II & III	50 or 100	50 or 100
7	Accuracy Class		
	(a) Winding-I	3 P	
	(b) Winding-II	0.2	
	(c) Winding-III	0.2	
8	Rated Voltage Factor and Duration		
	(a) Winding-I	1.2 continuous and 1.5 for 30 seconds	
	(b) Winding-II	1.2 continuous and 1.5 for 30 seconds	
9	Reference Standard for insulating oil	IS 335 with latest amendments	

E) Minimum acceptable specifications of dedicated single-phase HV potential transformers (PT) for metering

S. No.	Particulars	33kV	11kV
1	Nominal System Voltage (kV rms)	33	11
2	Highest System Voltage (kV rms)	36	12
3	Reference Standard	IS 3156 with latest amendments	
4	No. of Secondary Windings for potential measurement devices	**Three**	**Three**
5	Standard Voltage Ratio	33kV/√3 / 110V/√3	11kV/√3 / 110V/√3
6	Rated Secondary Burden (VA) per winding		
	(a)Winding-I	-----	-----
	(b) Winding-II	50	50
	(c) Winding-III	50	50
7	Accuracy Class(At 10% to 100% of rated VA burden)	0.2	0.2
	(a) Winding-I	3 P	
	(b) Winding-II	0.5	
	(c) Winding-III	0.5	
8	Rated Voltage Factor and Duration	1.2 continuous and 1.5 for 30 seconds	

8.8 Testing Arrangements

8.8.1 At the time of commissioning, each interface meter shall be tested by the owner at site for accuracy using standard reference meter of better accuracy class than the meter under test. The test terminal blocks shall be provided on all meters to facilitate testing of meters. Portable test set with high accuracy static source and 5 times more accurate (or better) electronic reference standard meter shall be used for testing. This means at least class 0.1S reference standard meter for testing of class 0.2S meter, class 0.1S reference standard meter for testing of class 0.5S meter and class 0.2S reference meters for testing of class 1.0S meter. These benches shall also be used for checking and calibration of portable testing equipments. The above shall be applicable for laboratory testing of meters, however, for site testing meter testing equipments with one class higher accuracy than meter under test may be used as per provision of IS-12346-1999.

8.8.2 Separate test terminal blocks for testing of main and check meters shall be provided so that when one meter is under testing, the other meter continues to record actual energy during testing period. Where only one/main meter exists, an additional meter shall be put in circuit

during the testing period of the main meter so that while the main meter is under testing, the other meter can record energy during the period of meter under testing.

8.9 System for joint inspection, testing, calibration of interface meter

8.9.1 The metering system located at metering points between generating plants, State transmission utility and distribution licensees shall be regularly inspected, tested and calibrated once in a year but at least once in five year (or at an interval lesser than one year as mutually agreed) jointly by both the agencies involved for dispatch and receipt of energy. Since the static trivector meters are calibrated through software at the manufacturers' works, only accuracy of the meters and functioning shall be verified during joint inspection. In case of any doubt or defect, the meter shall be replaced then and there or calibrated. In later case, error correction as determined will be applied to the meter reading for the purpose of billing. To cover for loss of time, spare meters shall always be kept available with the agency to whom the meter/metering point belongs. After testing, the meter shall be properly sealed and a joint report shall be prepared giving details of testing work carried out, details of old seals removed and new seals affixed, test results, further action to be taken (if any) etc.

8.9.2 Joint inspection shall also be carried out as and when difference in meter readings (so corrected) exceeds the permissible error as per accuracy class of main and check meter. The meters shall be jointly tested/ calibrated on all loads and power factors as per relevant standards through static phantom load.

8.10 Meter Sealing Provision

8.10.1 Polycarbonate or acrylic seals or plastic seals or holographic seals or any other superior seal shall be used.

8.10.2 Lead seals shall not be used in the new meters. Old lead seals shall be replaced by new seals in a phased manner and the time frame of the same shall be submitted by the licensee to the Appropriate Commission for approval.

8.10.3 Metering systems shall be jointly sealed by the authorized representatives of the concerned parties. The sealing of meter shall be arranged as per the provisions in CEA (Installation and Operation of Meters) Regulation 2006.

8.10.4 No seal, applied pursuant to this metering code, shall be broken or removed except in the presence of or with the prior consent of the agency affixing the seal or on whose behalf the seal has been affixed unless it is necessary to do so in circumstances where (i) there occurs a fire or similar hazard and such removal is essential and such consent cannot be obtained

immediately (ii) such action is required for the purpose of attending to the meter failure. In such circumstances, verbal consent shall be given immediately and it must be confirmed in writing forthwith.

8.11 Procedure for Assessment of Consumption In Case of Defective and/or Stuck-Up Meter

8.11.1 (a) Whenever difference between the readings of the Main meter and the Check meter for any month is more than 0.5%, the following steps shall be taken:

(i) checking of CT and VT connections;

(ii) testing of accuracy of interface meter at site with reference standard meter of accuracy class higher than the meter under test.

If the difference exists even after such checking or testing, then the defective meter shall be replaced with a correct meter.

(b) In case of conspicuous failures like burning of meter and erratic display of metered parameters and when the error found in testing of meter is beyond the permissible limit of error provided in the relevant standard, the meter shall be immediately replaced with a correct meter.

(c) In case where both the Main meter and Check meter fail, at least one of the meters shall be immediately replaced by a correct meter.

8.11.2 When main meter is found to be defective or has stopped, reading of the check meter shall be considered for billing purpose subject to condition that the check meter has been found working properly.

8.11.3 In case of outage of both the main and check meters, if any energy is interchanged in the intervening period the assessment has to be done on the basis of reading recorded in generator's sending end meter (standby mcter) if found working properly by considering average of previous 3 months percentage line loss when both interface meter and generators meter were found working properly.

8.11.4 In case of outage of both the main meters and check meters so also generator's sending end meters (Standby), the energy injected into the State grid may be assessed on the basis of average of previous three months energy loss calculated of the respective sub-station of licensee when main/check meters were working properly.

Readings recorded by Main, Check and Standby meters for every time slot shall be analysed, crosschecked and validated by the State Load Despatch Centre (SLDC). The discrepancies, if any, noticed in the readings shall be informed by the SLDC in writing to the

energy accounting agency for proper accounting of energy. SLDC shall also intimate the discrepancies to the State Transmission Utility or the licensee, who shall take further necessary action regarding testing, calibration or replacement of the faulty meters in accordance with the provisions laid down.

8.11.5 In case the meter installed in premises of bulk consumer who is availing open access or supplied directly from transmission network becomes defective the assessment of energy drawal is to be done as per provisions specified for the consumer in C.G.State Electricity Supply Code as mended to time to time.

8.11.6 The STU shall install special energy meters on all inter connections between the regional entities and other identified points for recording of actual net MWh interchanges and MVArh drawals. The installation, operation and maintenance of special energy meters shall be in accordance with Central Electricity Authority (Installation and Operation of Meters) Regulations, 2006. All concerned entities (in whose premises the special energy meters are installed) shall take weekly meter readings and transmit them to the SLDC by Monday noon. The SLDC must ensure that the meter data from all installations within their control area are transmitted to the RLDC as per the schedule.

8.12 Replacement of defective or stuck-up meter

A defective or stuck-up meter shall be replaced within 15 (fifteen) days. The owner of the meter shall maintain spare inventory of meters, so that down time is minimized.

8.13 Mechanism for dispute resolution

Any disputes relating to inter-utility metering between State transmission utility and any generating company/distribution licensees/intra-state users shall be settled in accordance with procedures given under relevant power purchase agreements (PPA)/connection agreement or relevant agreement, as the case may be. In case of unresolved dispute, the matter may be referred to the Commission.

8.14. To keep pace with continuous and fast up-gradation in the technology of metering and communication, the metering code needs to be reviewed periodically as per CEA Regulations/guidelines and the Commission may issue directives from time to time.

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CHAPTER - 9

CONTINGENCY PLANNING

9.1 General Principles

9.1.1 To define the responsibilities of all the intra-state users for achieving the fastest possible recovery of the grid in the event of a failure in the transmission system, or any sudden loss of Generation or a blackout caused due to the failure of the Western Grid. All hydro stations should compulsorily have Black start facilities and all EHV substation at 220 kV and above should have synchronizing facilities to meet the contingency. During the blackout procedure to be adopted for fast recovery shall take into account the following:

i. The possible transfer of power from the neighboring System through Inter State transmission lines,

ii. The extent of immediate availability of power from the Central Sector generating stations and the generating plants.

iii. Availability of power from any embedded generator connected to state grid.

9.1.2 The main objective is to achieve the following:

i. The essential loads required to be restored immediately.

ii. Restoration of the total system and associated demand in the shortest possible time.

iii. Resynchronization of parts of the system which have ceased to be in synchronism,

iv. To ensure that the communication arrangements for use in circumstances of serious disruption to the System are available to enable senior management representatives of the SLDC, the transmission licensee and the intra-state users who are authorized to take decisions on behalf of the transmission licensee or the intra-state user.

v. To ensure that the transmission system can operate in the event of the SLDC is incapacitated for any reason.

vi. The situation prevailing prior to the occurrence of the contingency, e.g. availability of specific generating stations, transmission lines, and load demands will largely determine the restoration procedure to be adopted in the event of a total blackout.

vii. The SLDC shall co-ordinate with WRLDC and STU in determining the extent of problems. The SLDC shall inform maximum intra-state users of the situation and advice them to follow the strategy as outlined in this section for restoration.

viii. The use of communication channels shall be restricted to the operational communications only, till normalcy is restored.

9.2 Total Regional Blackout:

In case of Total Regional Blackout, the recovery shall be as per the Black Start procedure prepared by WRLDC in consultation with all the constituents of western region. As these procedures are updated periodically, the last updated procedures shall be followed during the total regional blackout.

9.3 **Partial state transmission system blackout**:

In case of partial State transmission system blackout, the recovery shall be as per the Black Start/Restoration procedure prepared by SLDC in consultation with the intra-state users. As these procedures are updated periodically, the last updated procedures shall be followed during the partial state transmission system blackout. The instruction issued by SLDC in restoration of system from partial black out shall be followed by the intra-state users even though the same is not specifically mentioned in Black Start procedure/restoration document.

9.4 Responsibilities:

9.4.1 The SLDC shall maintain a record of Generating plants with black start capabilities and Black Start operation plans.

9.4.2 The SLDC shall prepare, distribute, and maintain up-to-date 'black start' procedures covering the restoration of the transmission system following total or partial blackouts. The intra-state users shall agree to these 'black start' procedures and inform promptly to the SLDC whenever they have difficulty.

9.4.3 The SLDC shall be responsible for directing the overall transmission system restoration process by co-ordination with all the intra-state users and in close co-ordination with the WRLDC.

9.4.4 The distribution licensees shall be responsible for sectionalizing the distribution system into discrete, unconnected blocks of load. They shall advise the SLDC as to the quantum of load likely to be picked up by the plants being synchronized.

9.4.5 The generating plants shall be responsible for commencing their planned 'black start' procedure on the instruction of the SLDC and steadily increasing their generation according to the demand intimated by the SLDC.

9.5 Special consideration:-

9.5.1 During the process of restoration of the transmission system, or regional system blackout conditions, the normal standards of voltage and frequency need not be applied, and left to the discretion of the SLDC as it considers appropriate depending on the prevailing situation.

9.5.2 The distribution licensee shall separately identify non-essential components of essential loads, which may be kept off during system contingencies. They shall also draw up an appropriate schedule with corresponding load blocks in each case. The non-essential loads can be put on only when the system normalcy is restored, and as advised by the SLDC.

9.5.3 All intra-state users shall pay special attention in carrying out the procedures to prevent secondary collapse of the system due to haste or inappropriate loading.

9.5.4 Despite the urgency of the situation, careful, prompt and complete logging of all operations and operational messages shall be ensured by all the intra-state users to facilitate subsequent investigation into the incident and the efficiency of the restoration process. Such investigation shall be conducted promptly after the incident, and SLDC shall place before the State Grid Coordination Committee for appraisal in its next immediate meeting.

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CHAPTER - 10
SAFETY STANDARDS

10.1 SAFETY STANDARDS:

10.1.1 The "Safety Standards" formulates the precautions to be taken for ensuring safety for the general public, consumers of electricity and the workmen. This forms an integral part of this Code and STU/transmission licensee and all the intra-state users shall comply with those Standards notified by CEA like CEA (Safety Requirements for Construction, Operation and Maintenance of Electric Plants and Electric Lines), Regulation, 2011, CEA (Measures relating to Safety and Electric Supply), Regulation, 2010.

10.1.2 (i) STU/transmission licensee shall prepare its own "Safety manual" for the transmission lines; Substations based on this standard. For the guidance of the Shift Operators, "Operation and Maintenance Manuals" for each Sub-station shall be prepared by the licensee. These manuals shall contain all the maintenance and operation schedules based on the recommendations of the manufacturers of the various equipments installed in the Sub-station. These manuals shall be periodically reviewed based on the experience gained and replacement of equipments. A maintenance register for the equipments including the station batteries shall be maintained at the respective Sub-stations. These shall be updated as and when the maintenance work is carried out and shall be periodically reviewed by the appropriate higher authority in whose control the sub-station falls. Similar registers shall be maintained for the transmission lines.

(ii) State transmission utility/Transmission Licensee shall appoint / designate suitable qualified person as designated Electrical Safety Officer for coordination of safety procedure / measure for ensuring observance of safety measures and function as specified in CEA (Safety Requirements for Construction, Operation and Maintenance of Electric Plants and Electric Lines), Regulation, 2011 and CEA (Measures relating to Safety and Electric Supply) Regulations, 2010.

10.1.3 The operation manual shall clearly contain the details of isolation and earthing to be provided for allowing work on the equipments. The single line Diagram of the Sub-station indicating the positions of various isolating devices shall be prominently displayed in the sub-station. Charts showing the clearances from live parts (section clearance) for working on the isolated equipments where workmen are allowed to work shall be displayed prominently at each sub-station.

10.1.4 The danger boards / danger notice as required in CEA (Measures relating to Safety and Electric Supply), Regulation, 2010 and relevant Indian Standard shall be displayed at places approachable by the general public.

10.1.5 Regular maintenance shall be carried out on all the transmission lines in accordance with IS:5613 and records shall be maintained. Wherever possible hot line checking and replacement of failed insulators and maintenance work shall be done before and after mansoon. The hot line techniques for maintenance of critical transmission lines and sub-stations shall be adopted wherever possible. Only trained staff shall be used for the hot line techniques and the tools employed in such techniques shall have necessary certification from a national or international accredited laboratory before usage.

10.1.6 All the equipments in the receiving stations and sub-stations shall be maintained in good condition as per the manufacturer's manuals and relevant Indian and/or International standards, wherever available. The relays and circuit breakers shall be checked, tested for their proper operation whenever these are taken out for maintenance purposes. The station batteries shall be maintained in good working condition by carrying out routine checks and maintenance works. The DC system provided in all these stations shall be properly maintained to ensure that leakage current is meagre. An on-line monitoring system for monitoring of leakage and detection of ground faults shall be provided. The diagnostic methods of maintenance shall be preferred over traditional time based maintenance. Thermo-vision scanning for hot spots on all overhead lines and sub-station equipment at voltage level of 220 kV and above shall be carried out at least once a year and necessary remedial measures shall be taken where hot spots are detected. The residual life assessment shall be carried out for all major equipments including transformers, reactors, breakers, as envisaged by the relevant standards. The use of diagnostic technique for condition based monitoring of equipments should be adopted as per Regulation 25 of CEA (Grid Standards) Regulation, 2010. Records of all maintenance is carried out for each equipment and shall be kept in the table and formats in electronic form and hard copy and the next due date for maintenance of each item of work shall be clearly marked in such tables and formats.

10.2 Line Clear Permit (LCP):

The format under **Annexure "C" and "D"** shall be used to request for permit to work on electrical line or equipment and to return the permit when the work on electrical line or equipment is over.

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Chapter - 11

OPERATIONAL EVENT AND INCIDENT REPORTING

11.1 Reportable Incidents:

11.1.1 All events in the transmission system shall be notified by STU/transmission licensee to SLDC and the intra-state users, whose systems are affected.

11.1.2 All events on the intra-state user's system having an operational effect on the transmission system shall be notified by the intra-state user to STU/transmission licensee and SLDC who in turn shall notify the other intra-state users on whose system the event may have an operational effect. The intra-state user shall submit incident report covering the points shown in clause 11.2.2 of this code.

11.1.3 Typical examples of reportable incidents that could affect the transmission system are as follows:

- (a) Exceptionally high/low voltage or frequency,
- (b) Serious equipment problem i.e. major circuit breaker, transformer, bus bar fault,
- (c) Major problem in the generating unit,
- (d) Tripping of ICT, transmission line or capacitor bank, reactor.
- (e) Major fire incident, cyclones, storms earthquakes etc.,
- (f) Major protection failure,
- (g) Over loading of equipment or transmission line which may result in hazard to the personnel,
- (h) Activation of any alarm or indication of abnormal operating condition,
- (i) Adverse climatic conditions being experienced or forecast,
- (j) Breakdown, or faults, or temporary changes in the capabilities of Plant and/or apparatus,
- (k) Impending risks of protection operation,
- (l) Loss of load,
- (m) Accidents,
- (n) Excessive drawal deviations,
- (o) Minor equipment alarms.

Note:

- (i) The last two reportable incidents are typical examples of those of lesser consequences, but still affect the transmission system and can be reasonably classified as minor.
- (ii) The examples indicated in the above are only illustrative and in no way limit the general requirements to be reported.

11.2 Reporting procedure:

11.2.1 All reportable incidents occurring in lines and equipments of 33kV and above at the grid sub-stations shall promptly be reported orally by the intra-state user whose equipment has experienced the incident to all other significantly affected intra-state users and SLDC. The reporting intra-state user should submit a written confirmation to SLDC within one hour of such oral report. If the reporting incident is of major nature, the written report may be submitted within two hours duly followed by a comprehensive report within 48 hours of the submission of the initial written report. In other cases, the reporting intra-state user shall submit a report within five working days to SLDC.

11.2.2 The SLDC shall call for a report from any intra-state user on any reportable incident affecting other intra-state users, in case such intra-state user, whose equipment might have been a source of the reportable incident, does not report the same. However, this shall not relieve any intra-state user from the obligation to report events in accordance with CEA (Measures relating to Safety and Electric Supply) Regulations, 2010 as amended from time to time.The format for such a report shall be as per the approval of the Grid Coordination Committee and typically contain the following:

(a) Location of the incident,
(b) Date and time of the incident,
(c) Plant or Equipment involved,
(d) Supplies interrupted and the duration wherever applicable,
(e) Amount of Generation lost, wherever applicable,
(f) System Parameters before and after the incident, (Voltage, Frequency, Flows, Generation etc.),
(g) Network configuration before the incident,
(h) Relay indications and performance of protection,
(i) Brief description of the incident,
(j) Estimated time of return to service,
(k) Any other relevant information,
(l) Recommendations for future improvement, and
(m) Name and designation of reporting officer.

11.2.3 The report shall contain sufficient details to describe the event to enable the recipient to assess the implications and risks arising out of the same. The cause need not be included in the report but the recipient may ask for clarifications wherever necessary and it is obligatory that the reporting intra-state user shall put his best efforts and provide all the necessary and reasonable information.

11.2.4 In case of a request by either party the oral report shall be written down by the sender and dictated by way of a telephone message or sent by fax/e-mail to the recipient. In case of an emergency the report can be given only orally and followed by written confirmation.

11.2.5 The maximum time limit allowed for oral report of the event is fifteen minutes from the time of the occurrence of the event.

11.2.6 SLDC will be responsible for reporting event in line with the procedure set in IEGC.

11.3 Significant events:

11.3.1 Significant event includes such events having an operational effect e.g.

(a) Tripping of plant and/or apparatus manually or automatically
(b) Voltage outside statutory limits
(c) System frequency outside statutory limits
(d) System instability or
(e) System overloads.

11.3.2 Wherever a intra-state user reports an event, which the SLDC or STU/transmission licensee considers to have had a significant effect on the transmission system, STU/transmission licensee may require the intra-state user to report that event in writing within one day.

11.3.3 Wherever STU/transmission licensee notifies SLDC and a intra-state user of any event which the intra-state user or SLDC considers to have had a significant effect on the intra-state users' system, the intra-state user may require the transmission licensee to report that event in writing within one day.

11.4 Warnings:

11.4.1 An oral warning shall be issued by SLDC and confirmed in writing as well, to the STU/transmission licensee and the intra-state users, who may be affected when SLDC knows that there is a risk of widespread and serious disturbance to the whole, or part of, the total system.

11.4.2 Provided that sufficient time is available, the warning shall contain such information, as the SLDC considers reasonable, to explain the nature, and extent of the anticipated disturbance, to the Intra-state user and STU/transmission licensee, provided that such information is available to SLDC.

11.4.3 Each intra-state user and STU/transmission licensee, on receipt of such a warning, shall take necessary steps to warn its operational staff and maintain its Plant and apparatus in the condition in which it is best able to withstand the anticipated disturbance for the duration as confirmed / warned.

11.4.4 Scheduling and dispatch may be affected during the period covered by such a warning.

11.5 Loss of communication with the SLDC:

11.5.1 In the event of loss of communication with SLDC the provision made as above shall not apply but instead the following provision shall apply:

11.5.2 Each generating plants shall continue to operate in accordance with the last dispatch instruction issued by SLDC, but shall use all reasonable endeavors to maintain the system frequency between 49.5 Hz to 50.2 Hz as per IEGC, 2010 until such time the new dispatch instructions are received from SLDC.

11.6 Major failure:

Whenever a major failure takes place, STU/ transmission licensee and other intra-state users shall co-operate, inquire establish the cause of such failure and produce appropriate recommendations. STU shall submit the enquiry report to the Grid Coordination Committee.

11.7 Accident reporting:

11.7.1 If any accident occurs in connection with the generation, transmission, distribution, supply or use of electricity or in connection with any part of electric lines or electrical plant of any person and the accident results or is likely to have resulted in loss of human life or any injury to a human being the same shall be dealt accordance with CEA (Safety Requirements for Construction, Operation and Maintenance of Electrical Plants and Electric Lines) Regulations, 2008 as amended from time to time.

11.7.2 Reporting of accidents shall be done to concern authority as per prevailing rules.

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CHAPTER - 12

DATA REGISTRATION

12.1 Responsibility:

12.1.1 All the intra-state users are responsible for submitting the up-to-date data in accordance with the provisions of the Grid Code. All the intra-state users shall provide SLDC/STU, the names, addresses, and the telephone numbers of the persons responsible for sending the data. SLDC/STU shall inform all the intra-state users the names, addresses and telephone numbers of the persons responsible for receiving the data.

12.1.2 SLDC shall provide up-to-date data to intra-state users as provided in the relevant Chapters of the Grid Code.

12.1.3 Responsibility for the correctness of these data rests with the concerned intra-state users providing the data.

12.1.4 The data schedules are structured to serve as standard formats for data submission and these formats shall be used for written data submission. Wherever standard data formats are not given, these should be developed by SLDC/STU in consultation with the intra-state users.

12.1.5 Wherever a computer data link exists between the intra-state user and SLDC, data may be submitted through this link. The data shall be in the same format as specified for paper transmission except for electronic encoding for which some other format may be more appropriate. The intra-state user shall specify the method to be used in consultation with STU/SLDC and resolve issues such as protocols, transmission speeds etc., at the time of transmission.

12.2 Changes in intra-state user's data:

12.2.1 Whenever the intra-state user becomes aware of the change to any items of the data registered under license, the intra-state user must promptly notify the SLDC of the changes. SLDC on receipt of the changes shall promptly correct the database accordingly. This shall also apply to any data compiled by SLDC regarding his own system.

12.3 Data not supplied:

All the intra-state users are obliged to supply the data referred to in the individual Sections of the Grid Code and listed above. In case any data is missing and not supplied by the intra-state user, SLDC may act reasonably. If and when necessary, he may estimate such data depending upon the urgency of the situation. Similarly in case any data is missing and not supplied by SLDC, the concerned intra-state user may, act reasonably. If and when necessary, he may estimate such data depending upon the urgency of the situation. Such estimates, in each case, shall be based upon the corresponding data for similar plant or apparatus, or upon such other information, the intra-state user or SLDC, as the case may be deems appropriate.

12.4 Special considerations:

SLDC or any intra-state user may at any time make reasonable request for extra data as necessary.

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CHAPTER - 13
MISCELLANEOUS

13.1 Other Codes and Regulations

Intra-state user(s) shall ensure that new buildings, structures, additions, modifications and any other construction projects keep the minimum clearances required from existing supply lines of the licensee. These minimum clearances are specified in the CEA (Measures relating to Safety and Electric Supply) Regulations, 2011.

13.2 Non-Compliance & Derogation

13.2.1 If any intra-state user is not in a position to comply, or fails to comply, with any of the provision(s) of the Grid code, it shall inform SLDC without delay of the reason for its non-compliance and shall take remedy for its non-compliance promptly.

13.2.2 Wrong declaration of capacity, non compliance of SLDC's load dispatch instructions, non-compliance of SLDC's instructions for backing down without adequate reasons, non-furnishing of data etc. shall constitute non-compliance of the Grid Code, which shall be subject to penal action as may be decided by the Commission.

13.2.3 Derogation, if any, for any particular section or chapter of this Grid Code shall be with the permission of the Commission and for a specified time. Derogation of any requirement of the Grid Code shall be an exception and not the norm, and will be allowed only when it is not possible, and not just difficult or inconvenient, for the intra-state user to comply in the required time. Failure to comply with time period allowed for derogation by any intra-state user shall carry a penalty as decided by Commission.

13.3 Service of Notice

Any letter, order or document addressed by the SLDC/licensee to the intra-state user shall be deemed to be duly given, if served in writing and delivered by hand at, or sent by post/ courier / fax / e-mail to the intra-state user address specified in the consumer's application or in the agreement with the intra-state user if entered into or as subsequently notified to the licensee. In case there is no person on the premises to whom the notice can with reasonable diligence be delivered, the notice may be served by affixing it on some conspicuous part of the premises.

All communications to the SLDC/licensee shall be made to the address as provided by SLDC/licensee.

13.4 **Unforeseen Circumstances / Force Majeure**

(a) Unforeseen Circumstances If any circumstances / force majeure not envisaged in the provisions of the Grid Code, should arise, the licensee/SLDC shall, to the extent reasonably practicable in the circumstances, consult promptly and in good faith, all affected parties in an effort to reach an agreement as to what should be done. If an agreement cannot be reached between the licensee and intra-state user within the time available, the licensee/SLDC shall determine it in the manner to the best of its ability.

Wherever the licensee/SLDC makes such a determination, it shall do so having regard, wherever possible, to the views expressed by the affected parties and, in any event, to what is reasonable in the circumstances. Each party shall comply with all instructions given to it by the licensee/SLDC. The licensee/SLDC shall promptly refer all such unforeseen circumstances/force majeure, and any such determination to the Commission.

(b) Force Majeure:

Any event which is beyond the control of the intra state user involved which they could not foresee or with reasonable amount of diligence could not have foreseen or which could not be prevented and which substantially affect the performance by either agency such as but not limited to: -

(i) Acts of God, natural phenomena, including but not limited to floods, droughts, earthquakes and epidemics;

(ii) Acts of any Government domestic or foreign, including but not limited to war declared or undeclared, hostilities, priorities, quarantines, embargoes;

(iii) Riot or civil commotion;

(iv) Grid's failure not attributable to agencies involved."

13.5 Interpretation:

These conditions shall be read and construed as being subject, in all respects, to the provisions of the Indian Governmental Instrumentality and having force of law and Electricity Act, 2003, and the rules or/and regulations framed there under, including those issued/framed by Commission as amended or re-enacted from time to time.

In case of any dispute regarding the meaning or scope or interpretation of this Code, the interpretation of the Commission shall be final and binding on all concerned.

13.6 Power to remove difficulties/Power to relax:

If any difficulty arises in giving effect to any of the provisions of this code, the matter may be referred to the Commission who after consulting the parties affected, where considered necessary, may pass any general or special order, not inconsistent with the provisions of the Act or any other enactment relating to transmission supply of electricity for the time being in force, which appears necessary or expedient, for the purpose of removing the difficulty.

The Commission may issue directions relieving any Transmission Licensee or Intra-state user, either suo-motu or based on an application submitted by such Transmission Licensee or Intra-state user, of their obligations to implement or comply with the State Grid Code to the extent as may be stipulated in the directions.

13.7 Jurisdiction of Court:

All proceedings arising out of this Code and the agreement made there under shall be filed only in the Court under whose jurisdiction the agreement was executed.

13.8 Repeal

With the notification of this grid code the Chhattisgarh State Electricity Grid Code, 2007 and its modification issued on dated 09-09-2008 shall cease to operate from the date of notification of this grid code.

13.9 Savings

Nothing in this Code shall be deemed to limit or otherwise affect the inherent power of the Commission to make such orders as may be necessary to meet the ends of justice or to prevent abuses of the process of the Commission.

Nothing in this Code shall bar the Commission from adopting in conformity with the provisions of the Act, a procedure, which is at variance with any of the provisions of this Grid Code, if the Commission, in view of the special circumstances of a matter or class of matters and for reasons to be recorded in writing, deems it necessary or expedient for dealing with such a matter or class of matters.

Nothing in this Code shall, expressly or impliedly, bar the Commission dealing with any matter or exercising any power under the Act for which no provision has been made in the Grid Code, and the Commission may deal with such matters, powers and functions in a manner it thinks fit.

Note: In case of any difference in the interpretation or understanding of the provisions of the Hindi version of these Regulations with those of the English version, the decision of the Commission shall be final and binding.

By order of the Commission,
N. K. RUPWANI, Secretary.

Annexure A

PLANNING DATA REQUIREMENTS (CLAUSE 3.4)

PART - I

GENERATION

(To be furnished by the Generating Company to STU)

A-1 Standard Planning Data (Generation)

A.1.1 THERMAL

I. GENERAL

1. Site	Furnish location map (schematic) showing roads, Railway lines, transmission lines, rivers and reservoirs if any.
2. Approximate period of construction	
3. Annual Generation in Million KWH	

II. CONNECTION

1. Connection point / interface point	Furnish single line diagram of the proposed connection with the transmission system with clear indication of possibility for right of way for unobstructed outlet
2. Step up voltage for connection kV	

III. STATION CAPACITY:

1. Total Generating Station Capacity (MW	
2. No. of Units and Unit size MW.	State whether development will be carried out in phases and if so, furnish details

IV. GENERATING UNIT DATA:

1. Steam Generating Unit	
Type,capacity, steam pressure,steam temperature etc-	
2.Steam turbine	
Type ,Capacity	

3.Generator	
(a) Make and Type	
(b) Rating (MVA)	
(c)Terminal Voltage (kV)	
(d) Rated Power Factor	
(e) Reactive Power capability (MVAr) in the range 0.95 leading and 0.85 lagging.	
(f) Short Circuit Ratio	
(g) Direct axis transient reactance (% on MVA rating)	
(h) Direct axis sub-transient reactance (% on MVA rating)	
(i) Auxiliary Power requirement	
(j) MW and MVAr Capability curve	
2. Generator Transformer	
(a) Type	
(b) Rated Capacity (MVA)	
(c) Voltage Ratio (HV/LV)	
(d) Tap change range (+% to -%)	
(e) Percentage Impedance (Positive Sequence at Full load).	

A.1.2 DETAILED PLANNING DATA (GENERATION) THERMAL GENERATING STATIONS:

I GENERAL:

a. Name of Generating Station:

b. No. of capacity of Generating Units (MW):

c. Single line diagram of Generating Station and switchyard

d. Relaying and metering diagram

e. Neutral Grounding of Generating Units

f. Excitation control

g. Earthing arrangements with earth resistance values

h. Communication – Details of PLCC and other communication equipment installed.

II PROTECTION AND METERING:

1. Full description including settings for all relays and protection systems installed on the Generating Unit, Generating Unit Transformers, Auxiliary Transformer and electrical motor of major equipment viz. boiler feed pump, ID fans, condensate extraction pump etc.
2. Full description including settings for all relays installed on all outgoing feeders from Generating Station switchyard, tie circuit breakers, incoming circuit breakers.
3. Full description of inter-tripping of circuit breakers at connection (point(s) / Interface points (s) with the transmission system.
4. Most probable fault clearance time for electrical faults on the intra-state user's system.
5. Full description of operational and commercial metering schemes.
6. Breaker operating time counting from initiation of protective relay to the opening of breaker.

III SWITCHYARD:

1. In relation to Interconnecting Transformers between EHV/HV transmission system and the Generator Transformer Voltage System:

   (a) Rated MVA

   (b) Voltage Ratio

   (c) Vector Group

   (d) Positive sequence reactance (Maximum, minimum, normal tap (% on MVA)

   (e) Positive sequence resistance (Maximum, minimum, normal tap (% on MVA)

   (f) Zero sequence reactance (% on MVA)

   (g) Tap changer range (+% to -%) and steps

   (h) Type of tap changer (OFF/ON)

   (i) Details of reactors, and other circuits connected to tertiary winding of ICT.

   (j) Method of grounding.

2. In relation to switchgear including circuit breakers, isolators on all circuits connected to the points of connection:

   (a) Rated Voltage (kV)

   (b) Type of Breaker (MOCB/ABCD/SF_6---)

   (c) Rated short circuit breaking current (kA) 3 phase

   (d) Rated short circuit breaking current (kA) 1 phase

   (e) Rated short circuit making current (kA) 3 phase

   (f) Rated short circuit making current (kA) 1phase

   (g) Provisions of auto reclosing with details

   (h) Details of instrument transformers.

3. Lightning arresters, technical data.
4. Communication – Details of PLCC and other communication equipment installed at connection point(s) / interface point(s).

5. Basic insulation level (kv):
   (a) Bus bar
   (b) Switchgear
   (c) Transformer bushings
   (d) Transformer windings

IV GENERATING UNITS:

A. PARAMETERS OF GENERATING UNITS:

1. Rated terminal voltage (kV)
2. Rated MVA
3. Rated MW
4. Inertia constant H(MW Sec./MVA) of Generator
5. Short circuit ratio
6. Direct axis synchronous reactance(% on MVA) (Both unsaturated and saturated)
7. Direct axis transient reactance(% on MVA) (Both unsaturated and saturated)
8. Direct axis sub-transient reactance(% on MVA) (Both unsaturated and saturated)
9. Quadrature axis synchronous reactance(% on MVA) (Both unsaturated and saturated)
10. Quadrature axis transient reactance(% on MVA) (Both unsaturated and saturated)
11. Quadrature axis sub-transient reactance(% on MVA) (Both unsaturated and saturated)
12. Direct axis transient open circuit time constant (Sec) T'_{do}
13. Direct axis sub-transient open circuit time constant (Sec) T'_{do}
14. Quadrature axis transient open circuit time constant (Sec) T'_{do}
15. Quadrature axis sub-transient open circuit time constant (Sec) T'_{do}
16. Stator resistance (Ohm)
17. Stator leakage reactance (Ohm) T_a
18. Stator time constant (Sec)
19. Rated field current (A)
20. Open circuit saturation characteristic for various terminal voltages giving the exciting current to achieve the same.
21. Generator Capability Curve
22. Rated stator current (A)
23. Phase connection
24. Number of terminals brought out
25. Rated speed(rpm)
26. Rated frequency (Hz.)
27. Efficiency at MCR condition (percent)
28. Negative sequence current capability (I^2T)

29. Capacitance of generator stator winding to ground (microF/ph)
30. DC Resistance of rotor at 20^0 C (in ohm)
31. Zero sequence reactance X_0 (Percentage)
32. Negative sequence reactance X_2 (Percentage)
33. Negative sequence reactance R_2 (Percentage)
34. Sub-Transient S-C time constant (in second)
    a. Direct axis T"d
    b. Quadrature axis T"q
35. Transient S-C time constant (in second)
    a. Direct axis T"d
    b. Quadrature axis T"q
36. Machine saturation at 1.0 pu voltage in p.u.
37. Machine saturation at 1.2 pu voltage in pu
38. Percentage regulation
39. Short circuit characteristics curves.

B. PARAMETERS OF EXCITATION CONTROL SYSTEM:

1. Type of Excitation
2. Maximum Field voltage
3. Minimum Field voltage
4. Rated Field voltage
5. Gain factor
6. Feed back strength
7. Time constant for control amplifier
8. Time constant for Exciter
9. Time constant for Feed Back
10. Output voltage of control amplifier
11. Maximum output voltage of control amplifier
12. Minimum output voltage of control amplifier
13. Details of excitation loop in block diagrams showing transfer functions of individual elements using IEEE symbols along with set values
14. Dynamic characteristics of over – excitation Limiter
15. Dynamic characteristics of under – excitation Limiter
16. Exciter IEEE model / Type No.
17. Exciter response time.

C. PARAMETERS OF GOVERNOR / TURBINE:

1. Governor average gain (MW/Hz)
2. Speeder motor setting range
3. Time constant of steam or fuel Governor valve
4. Governor valve opening limits
5. Governor valve rate limits
6. Governor valve rate limits
7. Time constant of Turbine (HP, IP, LP)
8. Governor block diagram showing transfer functions of individual elements using IEEE symbols alongwith set valves
9. Type of governor, whether IEEE standard governor used
10. Regulation and droop
11. Fraction of total power generated HP, IP, LP turbine.
12. Maximum velocity limit HP, IP, LP turbine
13. Minimum velocity limit HP,IP, LP turbine.

D. OPERATIONAL PARAMETERS:

1. Min. notice required for synchronizing a Generating Unit for De-synchronization.
2. Min. time between synchronizing different Generating Units in a Generating Station.
3. The minimum block load requirements on synchronizing
4. Time required for synchronizing a Generating Unit for the following conditions:
   (a) Hot
   (b) Warm
   (c) Cold
5. Maximum Generating Unit loading rate for the following conditions:
   (a) Hot
   (b) Warm
   (c) Cold
6. Minimum load without oil support (MW)

V. PLANT PERFORMANCE:

1. Daily Demand Profile (Last Year)	Half hourly integrated demand through out the day
2. Units Generated (Million KWH)	
3. Units consumed in Auxiliaries (Million KWH)	

4. Units supplied from system to Auxiliary Load	
5. Seasonal Generation	

A.1.3 HYDRO ELECTRIC

I. GENERAL:

1. Site	Furnish location map (schematic) showing roads, Railway lines, transmission lines, rivers and reservoirs if any.
Whether storage type, run of river type	
Full reservoir level	
Tail race level	
Design head	
Minimum draw down level	
Reservoir level v/s energy poetential curve	
2. Approximate period of construction	
3. Annual Generation in Million KWH	

II. CONNECTION:

(AS APPLICABLE TO THERMAL GENERATING STATIONS MENTIONED ABOVE)

III. STATION CAPACITY:

(AS APPLICABLE TO THERMAL GENERATING STATIONS MENTIONED ABOVE)

IV. GENERATION UNIT DATA:

1. Operating Head	
a)Maximum	
b)Minimum	
c)Average	
Hydro Unit	
a) Capability to operate as synchronous condenser	
b) Water head versus discharge curve(at full and part load)	
c) Power requirement or water discharge while operating as synchronous condenser	
2.Turbine	
Type .Capacity	

3.Generator	
(a) Make and Type	
(b) Rating (MVA)	
(c) Terminal Voltage (kV)	
(d) Rated Power Factor	
(e) Reactive Power capability (MVAr) in the range 0.95 leading and 0.85 lagging.	
(f) Short Circuit Ratio	
(g) Direct axis transient reactance (% on MVA rating)	
(h) Direct axis sub-transient reactance (% on MVA rating)	
(i) Auxiliary Power requirement	
2. Generator Transformer	
(a) Type	
(b) Rated Capacity (MVA)	
(c) Voltage Ratio (HV/LV)	
(d) Tap change range (+% to -%)	
(e) Percentage Impedance (Positive Sequence at Full load).	

A.1.4 HYDROELECTRIC STATIONS:

I. GENERAL:

1. Name of Generating Station
2. No. and capacity of units (MW)
3. Expected level of generation (MU)
4. Period of generation (in months) oer year
5. Whether the plant is based on water released from dam/canal for irrigation purposes
6. Rating of al major equipments.
7. Single line diagram of Generating Station and switchyard
8. Relaying and metering diagram
9. Neutral grounding of generator
10. Excitation control
11. [illegible] values
12. [illegible] communication [illegible]

II. PROTECTION:

(AS APPLICABLE TO THERMAL GENERATING STATIONS MENTIONED ABOVE)

III. SWITCH YARD:

(AS APPLICABLE TO THERMAL GENERATING STATIONS MENTIONED ABOVE)

IV. GENERATION UNITS:

A. PARAMETERS OF GENERATING UNITS:

(AS APPLICABLE TO THERMAL GENERATING STATION MENTIONED ABOVE)

B. PARAMETERS OF EXCITATION CONTROL SYSTEM:

(AS APPLICABLE TO THERMAL GENERATING STATION MENTIONED ABOVE)

C. PARAMETERS OF GOVERNOR / TURBINE:

(AS APPLICABLE TO THERMAL GENERATING STATION MENTIONED ABOVE)

D. OPERATIONAL PARAMETERS:

1. Minimum notice required for synchronizing a Generating Unit for De-synchronization.
2. Minimum time between synchronizing different Generating Units in a Generating Station
3. Minimum block load requirements of Synchronizing.

A1.5 FOR THERMAL

I. GENERATING STATIONS, if desired by STU:

CONNECTION:

1. Report of studies of parallel operation with transmission system:
   (a) Load flow studies
   (b) Stability studies
   (c) Short Circuit studies
2. Proposed connection with transmission system
   (a) Voltage
   (b) No. of circuits
   (c) Connection point (s) / interface point (s)

II. HYDROELECTRIC GENERATING STATIONS:

(AS APPLICABLE TO THERMAL GENERATING STATIONS MENTIONED ABOVE)

PART II – DISTRIBUTION

(To be furnished by the Distribution Company to STU)

B-1 Standard Planning Data Distribution

I. GENERAL:

1. Single Line Diagram : Licensee-wise upto 33kV Substations
2. Consumer Data: Furnish category wise number of consumers, their connected Loads to the best judgment of the distribution licensee.
3. Reference to are officers presently incharge of the distribution.

II. CONNECTION:

1. Connection points/interface points: Furnish single line diagram showing connection points / interface points.
2. Voltage of supply at connection points/interface points:
3. Names of grid Sub-station feeding the connection pints / interface points:

III. LINES AND SUB-STATIONS:

1. Line Data: Furnish length of line and voltages (EHV level)
2. Sub-station Data: Furnish transformer details of 220/132kV, 132/33kV, 33/11kV, Sub-stations, capacitor installations.

IV LOADS

1. Loads drawn at connection points/ interface points:	If the distribution licensee receive power at a number of connection points in a compact area, which are interconnected in a ring, then such distribution licensee shall forward the overall load drawn for overall Area of Supply as well as at each connection point with the variation or tolerance as mutually discussed and agreed upon with the STU

2. Details of loads fed at EHV, if any	Give name of consumer, voltage of supply, contract demand and name of grid Sub-station from which the line is drawn, length of EHT line from grid Sub-station to consumer's Premises.

V. DEMAND DATA (FOR ALL LOADS 5 MW AND ABOVE):

1. Type of Load & Rating in HP or KW	State whether furnace loads, rolling mills, traction loads, other industrial loads, pumping loads etc.
2. Rated voltage:	
3. Electrical loading of equipment	State number and size of motors, rating or arc furnaces/induction furnace, types of drive and control arrangements.
4. Sensitivity of load to voltage and Frequency of supply:	
5. Maximum harmonic content of Load:	
6. Average and maximum phase unbalance of Load:	
7. Nearest Substation from which load is to be fed:	
8. Location map to scale:	Map shall show the location of load with reference to lines and sub-stations in the vicinity.

VI LOAD FORECAST DATA:

1. Peak load for connection point / interface point as well as peak load and energy forecast of Area of Supply for each of the succeeding 10 years.
2. Details of methodology and assumptions on which forecasts are based
3. Details of load 5MW and above:

B-2 DETAILED PLANNING DATA (Distribution)

I. GENERAL:

1. Schematic Single Line Diagram of Distribution System (showing distribution lines from connection point / interface points with transmission system 220kV/ 132kV, 132/33kV, & 33/11 kV Substations, consumer bus if fed directly from transmission system).
2. Numbering and nomenclature of lines and substations (Identified with feeding grid Substations of the transmission system and concerned 220kV/132kV, 132/33kV, and 33/11kV substation).

II CONNECTION:

1. Connection point / interface points (Furnish details of existing arrangement of connection).
2. Details of metering of connection points / interface points.

B.3 DETAILED PLANNING DATA (Distribution)

(For submission on request by STU)

I CONNECTION:

1. Connection pints/ interface points as applied for:
   (a) New
   (b) Upgrading existing connection
2. Changes in metering at connection pints / interface points.

II. LOADS:

1. Details of major loads of 1 MW and above to the contracted for next ten years.

***

Annexure – B.

DETAILED TRANSMISSION SYSTEM DATA (CLAUSE 3.5)

(To be furnished to the Intra-state user on request by STU/ Transmission Licensee)

B-1 Standard Planning Data (Transmission)

1. Name of the line: (Indicating Generating Stations and Substations to be connected)
2. Voltage of line (kV):
3. No. of circuits:
4. Route length (CKM):
5. Conductor sizes:
6. Line parameters (PU on 100 MVA base or ohmic values) — Resistance/KM; Inductive Reactance/KM; Suceptance/KM
7. Approximate power flow MW & MVAr:
8. Line Route (Topographic Sheets)
9. Purpose of connection: — Reference to scheme, wheeling to other States etc.
10. Approximate period of construction:

B-2 DETAILED SYSTEM DATA (Transmission): I. GENERAL:

1) Single line diagram of the transmission system upto 33kV bus at grid sub-station.
2) Name of substation
3) Generation Station connected
4) Number and length of circuits
5) Interconnecting Transformers
6) Substation bus layouts
7) Power transformers
8) Reactive compensation equipment
   (a) The details of capacitors installed
   (b) Additional capacitors to be commissioned along with additional loads.
9) Lightning arresters
10) Bus and / or line reactors

II SUB-STATION LAYOUT DIAGRAMS SHOWING:

1. Bus bar layouts
2. Electrical circuitry, lines, cables, transformers, switchgear etc.
3. Phasing arrangements
4. Earthing arrangements
5. Switching facilities and interlocking arrangements
6. Operating voltages
7. Numbering and nomenclature
   (a) Transformers
   (b) Circuits
   (c) Circuit breakers
   (d) Isolating switches

III LINE PARAMETERS: (FOR ALL CIRCUITS)

1. Designation of line
2. Length of lien (KM)
3. No. of circuits, size and type of conductor, thermal rating
4. Per circuit values
   a. Operating voltage (kV)
   b. Positive phase sequence reactance – ohms/KM
   c. Positive phase sequence resistance – ohms/KM
   d. Positive phase sequence suceptance – ohms/KM
   e. Zero phase sequence reactance – ohms/KM
   f. Zero phase sequence resistance – ohms/KM
   g. Zero phase sequence suceptance – ohms/KM

IV. TRANSFORMER PARAMETERS:
(FOR ALL TRANSFORMERS SUB-STATION-WISE)

1. Rated MVA
2. Voltage ratio
3. Vector group
4. Positive sequence reactance on rated MVA base (Max. Min & normal)
5. Positive sequence resistance on rated MVA base(max. min. & normal)
6. Zero sequence reactance on rated MVA base
7. Tap change range (+%-to -%) and steps
8. Details of tap changer (OFF/ON)
9. Neutral grounding transformer/resistor values
10. % Impedance (Max./Min/Normal Tap)

V. EQUIPMENT DETAILS: (FOR ALL SUB-STATIONS):

1. Circuit breakers
2. Isolating switches
3. Current transformers
4. potential transformers
5. Lightning arresters
6. Earthing switches

VI. RELAYING AND METERING:

1. Relay protection installed for all transformers and feeders along with their settings and level, of coordination with other uses.
2. Metering Details.

VII SYSTEM STUDIES:

1. Load flow studies (Peak and lean load for maximum Hydro and maximum Thermal Generation).
2. Transient stability studies for 3 Phase fault in critical lines, and single pole reclosing for 400 kV lines and critical 220kV lines.
3. Dynamic stability studies
4. Short circuit studies (3 phase and single phase to earth)
5. Transmission and distribution losses in the system.

VIII: DEMAND DATA: (FOR ALL SUB-STATIONS)

1. Demand Profile (Peak and off Peak load)

7. Forecast for next 5 years.

IX REACTIVE COMPENSATION EQUIPMENT:

1. Type of equipment (fixed or variable)
2. Capacities and/or inductive rating (Voltage and MVAr) or its operating range.
3. Details of control
4. Connection point/ interface point to the system.

B.3 DETAILED PLANNING DATA (Transmission):

I. CONNECTION:-

1. Single Line Diagram showing position of connection.
2. Sub-station layout diagram
   - (a) New
   - (b) Addition and alteration

3. Revised system studies with changed parameters
4. Connection point / interface point:
   a. Voltage
   b. Length of circuit
   c. Circuit parameters
   d. PLCC facilities
   e. Relaying with inter tripping arrangements to inter trip system breaker at connection point/ interface point to isolate on fault
   f. Metering at connection point / interface point
   g. Other communication facility

***

Annexure - C

ORIGINAL

(Safety) Form

PERMIT TO WORK ON ELECTRICAL EQUIPMENT OR LINE (Clause 10.2.1)

Issued to ....

I hereby declare that following electrical equipment / line is dead and isolated from all line conductors:-

Caution notices have been affixed to all the controlling switches,

Here state exactly the electrical equipment / line, on which it is safe to work.

Here state exactly the points the electrical equipment / line is connected to earth.

<u>All Other Equipment / Line are Live</u>

Here state any specific limits or instructions which issuer may liketo add :-

Signature ....

Designation ....

Date and Time ....

(when Permit is by phone. The name of the Authorized person at apposite end must be noted.)

Issuer(Sending end.)

Serial number of permit

(when permit is by phone Receiving end)

Note: 1) This card after being signed by a competent person for the work to proceed, is to be handed to the authorized person in charge of the work and retained by that person until the work is completed or stopped by the authorized person.

2) The electrical equipment mentioned hereon must not be again made alive until this card has been signed and returned by the person in charge of the work to the issuer of permit.

I hereby declare that all man, earthing and materials under my charge have cleared the site equipment / line and men have been warned that it is no longer safe to work on the electrical equipment specified on the card.

Signature ....

Designation ....

Date :

Time :

I hereby declare this card canceled.

Signature ....

Designation ....

Date :

Time :

Annexure - D

DUPLICATE

(Safety) Form

PERMIT TO WORK ON ELECTRICAL EQUIPMENT OR LINE (Clause 10.2.1)

Issued to ....

I hereby declare that following electrical equipment / line is dead and isolated from all line conductors:-

Caution notices have been affixed to all the controlling switches,

Here state exactly the electrical equipment / line, on which it is safe to work.

Here state exactly the points the electrical equipment / line is connected to earth.

<u>All Other Equipment / Line are Live</u>

Here state any specific limits or instructions which issuer may like to add :- (.....................

Signature ....

Designation ....

Date and Time ....

(when Permit is by phone. The name of the Authorized person at apposite end must be noted.)

Issuer(Sending end.)

Serial number of permit

(when permit is by phone Receiving end)

APPLICATION

From To

.... At

....

Please issue me permit to work on ......

....

....

Signature ....

Designation ....

संचालक, मुद्रण तथा लेखन सामग्री, छत्तीसगढ़ द्वारा शासकीय क्षेत्रीय मुद्रणालय, राजनांदगांव से मुद्रित तथा प्रकाशित—2012.